3. CAPE HENRY TO KEY WEST

(1) The Atlantic Coast of the United States from Cape Henry to Cape Florida is low and sandy, backed by woods. From Cape Florida to Key West the coast is formed by a long chain of small islands known as the Florida Keys. The Florida Reefs extend seaward of the keys and are nearly parallel to them.

(2) The coastline of Virginia from Cape Henry southward to the boundary of North Carolina is firm land for 13 miles; then it becomes a barrier beach, covered with sand dunes for 11 miles. The boundary between Virginia and North Carolina is the only marked boundary on this section of the coast. The easternmost boundary monument is a granite shaft 6 feet high about 0.5 mile west of the beach.

(3) The coastline of North Carolina is a long barrier beach. The islands are known as the **Outer Banks.** The banks are constantly shifting sand dunes varying in height. Three capes, with their offshore shoals, project from the islands, namely: Hatteras, Lookout, and Fear. Behind the barrier beach a chain of sounds, including Currituck, Roanoke, Albemarle, Pamlico, Core, and Bogue, stretch along the entire 300 miles of coastline of the State.

(4) Bordering the sounds on the mainland is a belt from 30 to 80 miles wide, where the land is level and sometimes swampy. On the north a portion of the Great Dismal Swamp spreads across the border of Virginia into North Carolina. Between Albemarle Sound and Pamlico River the swamplands are locally known as **Dismals** and **Pocosins.** They occur on the divides or watersheds between the rivers and sounds. In the southeast section of North Carolina are the **Savannas,** treeless prairie land with a thick growth of grass and wild flowers; they have been formed by a lack of drainage and a close impervious soil.

(5) The coastline of South Carolina from Little River Inlet to Winyah Bay is practically an unbroken beach. Cape Romain, just south of Winyah Bay, and the shoal extending seaward from it, form the southern point of indentations which has its northern point at Cape Fear. From Winyah Bay to Savannah River, the boundary between South Carolina and Georgia, the coastline is a border of sandy barrier islands. The large sounds so characteristic of the North Carolina coast are missing.

(6) The coastline of Georgia between Savannah River on the north and St. Marys River on the south is partly submerged at flood tide, and is broken by tidal rivers and marshes covered with dense grasses. The most important sandy islands off the coast are Tybee, Wassaw, Ossabaw, St. Catherines, Sapelo, St. Simons, Jekyll, and Cumberland.

(7) The coastline of Florida is a long, low, barrier beach from the border of Georgia south to Cape Florida. Many of the leading tourist resorts have been built on this beach, while the business districts are often on the mainland.

(8) Under the sand and the lagoons is a limestone called **Coquina,** which is soft while in its native state, but becomes a hard building stone when exposed to the air.

(9) Below Cape Florida the Florida Keys and Florida Reefs extend for about 134 miles in a southwesterly curve to Sand Key Light, and about 58 miles in a westerly direction to Loggerhead Key. These keys and reefs are of sand, shell, and coral formation. The keys are generally low and covered with mangrove.

(10) **Disposal Sites** and **Dumping Grounds.**–These areas are rarely mentioned in the Coast Pilot, but are shown on the nautical charts. (See Dump Sites and Dumping Grounds, chapter 1, and charts for limits.)

(11) **Aids to navigation.–**Lights are on or near the dangerous capes, at the entrance to the harbors, and along the Florida Reefs. The critical dangers are buoyed. The coast is well covered by loran. Radar, though always a valuable navigational aid, is generally of less assistance in navigation along this coast due to the relatively low relief; the accuracy of radar ranges to the beach cannot be relied upon. Coastal buoys equipped with radar reflectors are of help in this regard. It is sometimes possible to obtain a usable radar return from the larger lighthouses, but positive target identification is usually difficult. There are numerous aerolights along the coast that are useful for navigation, but they should not be confused with the marine lights.

(12) **COLREGS Demarcation Lines.**–Lines have been established to delineate those waters upon which mariners must comply with the International Regulations for Preventing Collisions at Sea, 1972 (72 COLREGS) and those waters upon which mariners must comply with the Inland Navigation Rules Act of 1980 (Inland Rules). The waters inside of the lines are **Inland Rules Waters,** and the waters outside of the lines are **COLREGS Waters.** (See **Part 80,** chapter 2, for specific lines of demarcation.)

(13) **Ports and Waterways Safety.–**(See **Part 160,** chapter 2, for regulations governing vessel operations and requirements for notification of arrivals, departures, hazardous conditions, and certain dangerous cargoes to the Captain of the Port.)

(14) **Harbor entrances.–**The entrance to every harbor on this stretch of the coast is more or less obstructed by a shifting sandbar over which the channel depth is changeable. The entrance channels of the larger and more important harbors have been improved by dredging; in some cases jetties have been built from both sides of the entrance. Many of the dredged channels in this area have a tendency to shoal soon after dredging because of the shifting sandy bottom.

(15) The buoys on many of the bars are not charted because they are moved from time to time to indicate the changing channel. They are liable to be dragged out of position and cannot always be replaced immediately, so a stranger must use the greatest caution. If possible, a stranger should enter a harbor or inlet on a rising tide.

(16) The tidal currents have considerable velocity in all of the entrances, and their direction is affected by the force and direction of the wind; sailing vessels entering the harbors and sounds require a fair working breeze during the ebb.

(17) Strangers should not attempt to enter the harbors without the assistance of a pilot during easterly gales when the sea breaks on most of the bars.

(18) **Depths.–**Between Cape Henry and Jupiter Inlet frequent soundings will give the mariner timely warning of his approach to the land from seaward.

(19) Northward of Cape Hatteras the 20-fathom curve is from 13 to 45 miles offshore, but inside of 15 fathoms the depths are irregular and many holes of limited extent are inside the general limits of corresponding depths; 10 to 14 fathoms are found in places only 1.5 miles offshore. This irregularity of depth is apt to confuse the mariner and lead him into danger in thick weather; the greatest caution should therefore be used inside of a depth of 20 fathoms. By keeping over 6 miles from the beach all dangers will be avoided, but the strong currents which sometimes set along the shore must be considered, especially after a gale.

(20) Southeastward of Cape Hatteras, and off the end of the shoals which extend seaward about 8 miles, the 20-fathom curve is from 12 to 15 miles offshore, and the 30-fathom curve is only a short distance farther. In thick weather, soundings of 20 fathoms or less should warn the mariner to keep offshore.

(21) From Cape Hatteras to Jupiter Inlet, the 20-fathom curve is fairly regular and for a greater part of the distance is from 40 to 55 miles offshore. Northward of St. Johns River, the water shoals uniformly to the 10-fathom curve, which, excepting in the two great bights between Cape Hatteras and Cape Fear, is from 10 to 30 miles offshore. Vessels bound for any of the harbors between Cape Fear and St. Johns River should approach the land with caution when in 10 fathoms of waters; inside the 10-fathom curve depths are irregular and spots of 5 fathoms or less will be found from 6 to 12 miles offshore. In thick weather vessels standing along the coast should keep a general depth of 10 fathoms between Cape Fear and St. Johns River.

(22) In a heavy sea, depths of less than 6 fathoms show discolored water; deep-draft vessels should be cautious about passing over such spots.

(23) Southward of St. Johns River, the 20-fathom curve draws inshore gradually and at Jupiter Inlet is only 4 miles from the beach, and the 100-fathom curve a little over 8 miles. Southward of Jupiter Inlet, both curves draw closer inshore, and along the Florida Reefs the 20-fathom curve is close in to the reefs, while the 100-fathom curve is at an average distance of about 7 miles outside the reefs. The 10-fathom curve between St. Johns River and Jupiter Inlet is irregular and of no use in determining distance from shore. Approaching Florida Reefs southward of Jupiter Inlet, soundings are of little use unless taken frequently as the water shoals rapidly from seaward.

(24) In the approach to the Bahama Banks along the Straits of Florida, the discolored water is the best indication the mariner has to warn him of shoal water; the 100-fathom curve at some points is only 1 or 2 miles from the shoal water of the banks.

(25) **Tropical waters.–**The most remarkable feature is the exceeding clearness of the sea water, enabling the bottom to be seen from aloft at considerable depths and at some distance. The navigation of the banks is consequently conducted almost entirely by the eye, but care must be taken not to run with the sun ahead of the vessel as that prevents the banks from being seen.

(26) The charts indicate clearly the positions of the many shoal heads, but considerable experience is required in identifying the patches by the color of the water. Small clouds, moving slowly and known to the pilots as **Flyers,** are apt to deceive the inexperienced, their reflection on the surface of the sea over the clear white sandy bottom has every appearance of rocky shoals. It is prudent to avoid a dark spot**.**

(27) **Bank Blink** is a phenomenon in tropical waters described as a bright reflected light hanging over the clear white sandbanks, serving to point them out from a considerable distance. From experience, it has been found to be untrustworthy, however, and should not be depended on in place of a lookout aloft. Soundings, dead reckoning, and fixes should be carefully checked and evaluated.

(28) **Anchorages.–**Vessels may find refuge at a number of places along the coast according to draft. The more important places are Lookout Bight, Beaufort Inlet, Cape Fear River, Winyah Bay, Charleston Harbor, Port Royal Sound, Savannah River, Sapelo Sound, St. Simons Sound, Cumberland Sound, St. Johns River, Fort Pierce Inlet, Lake Worth Inlet, Port Everglades, Miami, and Key West. A number of anchorage areas have been established by Federal regulations within the area of this Coast Pilot. (See **Part 110**, chapter 2, for limits and regulations.)

(29) **Dangers.–**Along the coast are a number of wrecks that are obstructions to navigation. Most of the dangerous wrecks are marked with lighted buoys. A careful check should be made of the chart to insure that dangerous wrecks are not along the routes selected.

(30) Trawlers or other vessels should exercise caution while dragging the ocean floor within a 25-mile radius of Cape Canaveral, Fla., since it is known that missile debris exist in the area, some of which may contain unexploded ordnance.

(31) Mariners are also cautioned against possible hazards of a weather rocket impact area that extends more than 50 miles offshore at Cape Canaveral, Fla. Falling rocket casings may be hazardous during the hours of 1930-2100 e.s.t., Monday through Friday.

(32) **Pipelaying barges.**–With the increased number of pipeline laying operations, operators of all types of vessels should be aware of the dangers of passing close aboard, close ahead, or close astern of a jetbarge or pipelaying barge. Pipelaying barges and jetbarges usually move at 0.5 knot or less and have anchors which extend out about 3,500 to 5,000 feet in all directions and which may be marked by lighted anchor buoys. The exposed pipeline behind the pipelaying barge and the area in the vicinity of anchors are hazardous to navigation and should be avoided. The pipeline and anchor cables also represent a submerged hazard to navigation. It is suggested, if safe navigation permits, for all types of vessels to pass well ahead of the pipelaying barge or well astern of the jetbarge. The pipelaying barge, jetbarge, and attending vessels may be contacted on VHF-FM channel 16 for passage instructions.

(33) **Danger zones** have been established within the area of this Coast Pilot. (See **Part 334,** chapter 2, for limits and regulations.) Submarine operating areas and transit lanes are off the North and South Carolina coasts. The areas are shown on the charts.

(34) **Drawbridges.–**The general regulations that apply to all drawbridges are given in **117.1 through 117.49**, chapter 2, and the specific regulations that apply only to certain drawbridges are given in **Part 117**, Subpart B, chapter 2. Where these regulations apply, references to them are made in the Coast Pilot under the name of the bridge or the waterway over which the bridge crosses.

(35) The drawbridge opening signals (see **117.15**, chapter 2) have been standardized for most drawbridges within the United States. The opening signals for those few bridges that are nonstandard are given in the specific drawbridge regulations. The specific regulations also address matters such as restricted operating hours and required advance notice for openings.

(36) The mariner should be acquainted with the general and specific regulations for drawbridges over waterways to be transited.

(37) **Routes–East coast of the United States to Key West.–**Proceed as direct as safe navigation permits to 35°08'N., 75°15'W., off Diamond Shoal Light, thence on rhumb lines through the following positions:

(38) Outer route to Jupiter Inlet Light

(39) 33°00'N., 75°35'W.

(40) 28°00'N., 79°00'W.

(41) 26°57'N., 80°00'W., off Jupiter Inlet Light

(42) Inner route to Jupiter Inlet Light

(43) 33°27'N., 77°32'W., off Frying Pan Shoals

(44) 32°00'N., 80°00'W.

(45) 31°00'N., 80°30'W.

(46) 29°30'N., 80°30'W.

(47) 28°39'N., 80°17'W., off Hetzel Shoal Lighted Whistle Buoy 8

(48) 27°24'N., 80°02'W., about 5.5 miles eastward of St. Lucie Shoal Lighted Whistle Buoy 12

(49) 26°57'N., 80°00'W., off Jupiter Inlet Light

(50) Thence follow the coast of Florida and the Florida Keys as close as safe navigation permits to Key West, with the following exception. Tank vessels and vessels greater than 50 meters (164 feet) in length are prohibited from entering the **Area To Be Avoided Off the Coast of Florida**. See Area To Be Avoided Off the Coast of Florida, indexed as such, this chapter. Vessel operators should exercise caution when entering Northern right whale critical habitat. See Northern right whales, indexed as such, this chapter.

(51) **Key West to east coast of the United States via Gulf Stream.** Follow the Gulf Stream in the Straits of Florida about 8 miles off the Florida Reefs, passing Fowey Rocks Light at a distance of 10 to 12 miles and Jupiter Inlet Light 15 miles, thence follow the main axis of the Gulf Stream in the Atlantic Ocean through the following positions:

(52) 30°25'N., 79°40'W.

(53) 31°11'N., 79°15'W.

(54) 34°00'N., 75°49'W.

(55) 35°08'N., 75°05'W., off Diamond Shoal Light;

(56) Thence as direct as safe navigation permits to destination.

(57) Southbound vessels from Diamond Shoal Light to Jupiter Inlet Light use either the outer route or the inner route to avoid the full northerly set of the Gulf Stream. Most of the regular lines bound for the Straits of Florida use the route outside the Gulf Stream. All vessels bound to any port as far south as the St. Johns River follow the coast inside the Gulf Stream. Currents up to 4.5 knots have been observed at 35°05.3'N., 75°19.7'W. (former position of Diamond Shoal Lightship). High current velocities usually occur during heavy or long continued gales. Currents produced by onshore winds are likely to set toward the shore. Details of the wind-driven currents are given in the Tidal Current Tables.

(58) The course from Diamond Shoal Light to 33°00'N., 75°35'W., along the outer route crosses the Gulf Stream. Under ordinary conditions an average allowance should be made for a 1-knot current setting northeastward for the entire run; with northeasterly winds there may be practically no current, whereas southerly, and especially southwesterly winds, may increase it considerably. Frequent fixes should be obtained.

(59) There is uncertainty as to the currents that may be expected on the course from 33°00'N., 75°35'W., to 28°00'N., 79°00'W., along the outer route. Frequent fixes should be obtained to guard against being set off course by the variable currents and also to insure clearing Matanilla Shoal.

(60) When crossing the Gulf Stream for Jupiter Inlet Light, **Matanilla Shoal** should be given a wide berth. The bank in the vicinity of the shoal is extremely dangerous, as the bottom is rocky and covered with dark seaweed, the water is not discolored, and the sea does not break. The current for some distance northward of the shoal is very uncertain and near the edge of the bank sets strongly toward it.

(61) **Caution.–**The charted position, size, shape, and orientation of the islands, banks, and shoals in the Bahama Islands are unreliable. Extraordinary caution should be exercised in the navigation of this area.

(62) When on the course northwestward of Matanilla Shoal an allowance should be made for a northerly current, averaging about 2.5 knots for the entire run of about 80 miles. It will, therefore, be necessary to shape the course sufficiently southward of Jupiter Inlet Light to allow for the northerly set. When fixing the position by bearings on the light, keep in mind that while outside the 100-fathom curve the vessel is probably in the full strength of the Gulf Stream, where the northerly current may average a velocity of 4 knots. If the light is on the starboard bow, the vessel will be much closer to it than indicated by the distance run between the successive bearings on it.

(63) The courses southward of Diamond Shoal Light on the inner route to Hetzel Shoal Lighted Whistle Buoy 8 have depths of 17 to 20 fathoms. In approaching and passing the shoals off Cape Canaveral, care must be exercised. The current of the Gulf Stream may be expected under ordinary conditions to set against the vessel for the entire run with a velocity of about 0.5 to 1 knot, the direction of the current following the curve of the coast. It must be remembered, however, that the effect of winds is almost immediately felt on the currents and that with northerly and especially northeasterly winds, a current of possibly 1 knot will set southward along the coast. Southerly, and especially southwesterly winds, increase the velocity of the Gulf Stream.

(64) On the inner route from Hetzel Shoal to Jupiter Inlet Light, the 15-fathom curve is a good guide. The current of the Gulf Stream may be expected under ordinary conditions to have a velocity of about 1 knot off Cape Canaveral increasing to 1.5 or 2 knots off Jupiter Inlet Light.

(65) Except for tank vessels and vessels greater than 50 meters (164 feet) in length, southbound vessels from Jupiter Inlet Light to Fowey Rocks Light usually follow the coast at a distance offshore of 1 to 1.5 miles to Hillsboro Inlet Light, thence 1.5 to 2 miles offshore, passing 1 mile eastward of Miami Lighted Whistle Buoy M and Fowey Rocks Light. A northward current can be expected near the coast from northward of Jupiter Inlet to Fowey Rocks. The velocity of the current gradually increases as the axis of the Gulf Stream is approached.

(66) Southbound vessels from Fowey Rocks Light to Key West usually follow a course 1 to 2 miles off the Florida Reefs in the daytime and 2 to 4 miles off at night. The position should be checked on the aids as passed and on the lights and sectors at night. Care must be taken not to get inside of the line of reefs, daybeacons, buoys or lights, especially when passing parts of the reef that are well back of the edge and do not break or show near the surface. The color of the water does not always mark the edge of the reefs.

(67) **Warning.–**The **Area To Be Avoided Off the Coast of Florida** extends farther out from the Florida Reefs than 4 miles. As tank vessels and vessels greater than 50 meters (164 feet) are prohibited from entering the **Area To Be Avoided Off the Coast of Florida** the guidelines of standing off the Florida Reef "1 to 2 miles in daytime and 2 to 4 miles at night" do not apply to these vessels. See Area To Be Avoided Off the Coast of Florida, indexed as such, this chapter.)

(68) Except in the vicinity of Fowey Rocks, where the 100-fathom curve is only about 2 miles outside the reef, the 50-fathom curve is from 2 to 4 miles from Florida Reefs, and this is about the least depth that can be depended upon to insure safety in skirting them. To be useful, soundings must be taken very frequently when navigating this region; a recording echo-sounder should be of great value.

(69) The reefs are fringed in places with broken ground, which, as a measure of safety, should be avoided by deep-draft vessels where the depths are less than 10 or 12 fathoms.

(70) A number of vessels have been lost on the reefs between The Elbow and Molasses Reef, and extra caution should be observed in this locality. The extremely variable current against the vessel should be carefully considered in determining the position off Carysfort Reef Light from which to shape the course to lead well clear of The Elbow.

(71) Vessels bound for Habana generally shape the course for that port when abreast of Alligator Reef Light.

(72) Any crossing of the Gulf Stream should be regarded as difficult on account of the strong current of variable velocity, for which it may not be possible to make a proper allowance, and the abrupt shoaling inside the 100-fathom curve. The axis of the Gulf Stream is nearest the reefs from about 10 miles northward of Carysfort Reef Light to Molasses Reef Light 10.

(73) Northbound vessels from Key West to Cape Hatteras follow the Gulf Stream. The velocity of the current varies greatly in different localities and is also subject to sudden changes, due to wind, differences in barometric pressure, and the like, so that no fixed hourly rate can be given. Often high velocities will be carried between certain points and will suddenly drop off between others. Frequent fixes should be obtained to determine accurately the speed of advance. The greatest velocity is between Carysfort Reef and Jupiter Inlet, ranging from 2 to 4.5 knots.

(74) The course between Jupiter Inlet Light and 30°25'N., 79°40'W., should lead from 6 to 30 miles outside the 100-fathom curve. Northward currents of 1.5 to 3.5 knots may be expected. It is reported that between latitude 30°30' and 32°30'N. heavy tide rips will be experienced, indicating a change in the direction of the stream and not an increase in the velocity, and creating in stormy weather a very uncomfortable sea.

(75) When approaching Diamond Shoal great care must be taken to determine accurately the position of the vessel. The currents are subject to wide variations as indicated by observations taken from the former Diamond Shoal Lightship. At times during both summer and winter the Gulf Stream has great velocity; at other times none will be found, or a southerly set may be experienced with northerly winds. The general direction of the stream is northeast with a velocity of 1 to 2 knots, but on nearing 35°05.3'N., 75°19.7'W. (former position of Diamond Shoal Lightship), the current is reported to set well to the east-northeast and at other times nearly north. In northerly and northeasterly weather a dangerous heavy cross and confused sea usually is encountered in the stream between Jupiter Inlet and Cape Hatteras.

(76) **Note.**–The courses described above for using or avoiding the Gulf Stream are based on long term averages of the location of the stream and take into consideration the main shipping routes between the east and Gulf coasts. Mariners desiring to make fullest use of the stream should obtain the latest information on its location from NOAA Weather Radio stations. (See Location of the Gulf Stream, this chapter.)

(77) **Area to Be Avoided.**–The **Area to Be Avoided Off the Coast of Florida** (ATBAOCF) has been established. The ATBAOCF has been established in order to reduce the risk of large vessel groundings which are found to constitute a serious threat to the continued vitality of the marine environment of the Florida Keys. The ATBAOCF has been established under the authority of the Florida Keys National Marine Sanctuary and Protection Act, Public Law 101-605 (November 16, 1990). The ATBAOCF has also been adopted by the International Maritime Organization (IMO), effective November 16, 1991.

(78) Operation of tank vessels and vessels greater than 50 meters (164 feet) in length is prohibited within the ATBAOCF. The term "tank vessel" is defined to mean "a vessel that is constructed or adapted to carry, or that carries, oil or hazardous material in bulk as cargo or cargo residue"; 46 U.S.C. subpart 2101(39).

(79) Consistent with generally recognized principles of international law, and National Oceanic and Atmospheric Administration (NOAA)'s jurisdiction under section 307 of the Marine Protection Research and Sanctuaries Act, 16 U.S.C. subpart 1437, enforcement actions may include assessment of civil penalties of not more than $50,000 per violation. The above prohibition does not apply to necessary operations of public vessels, including operations essential for national defense, law enforcement, and responses to emergencies that threaten life, property, or the environment.

(80) The ATBAOCF is coterminous with the boundaries of the Florida Keys National Marine Sanctuary. The sections (four) of the ATBAOCF are defined by the following groups of co-ordinates.

(81) In order to avoid risk of pollution and damage to the environment of this sensitive area, all vessels with cargoes of oil and hazardous materials, and all vessels greater than 50 meters (164 feet) in length should avoid the area bounded by a line connecting the following points.

(82) **In the Vicinity of the Florida Keys**.–Reference NOS charts 11450 and 11466.

(83) (1) 25°45.00'N., 080°06.10'W.
(84) (2) 25°38.70'N., 080°02.70'W.
(85) (3) 25°22.00'N., 080°03.00'W.
(86) (4) 25°00.20'N., 080°13.40'W.
(87) (5) 24°37.90'N., 080°47.30'W.
(88) (6) 24°29.20'N., 081°17.30'W.
(89) (7) 24°22.30'N., 081°43.17'W.
(90) (8) 24°28.00'N., 081°43.17'W.
(91) (9) 24°28.70'N., 081°43.50'W.
(92) (10) 24°29.80'N., 081°43.17'W.
(93) (11) 24°33.10'N., 081°35.15'W.
(94) (12) 24°33.60'N., 081°26.00'W.
(95) (13) 24°38.20'N., 081°07.00'W.
(96) (14) 24°43.20'N., 080°53.20'W.
(97) (15) 24°46.10'N., 080°46.15'W.
(98) (16) 24°51.10'N., 080°37.10'W.
(99) (17) 24°57.50'N., 080°27.50'W.
(100) (18) 25°09.90'N., 080°16.20'W.
(101) (19) 25°24.00'N., 080°09.10'W.
(102) (20) 25°31.50'N., 080°07.00'W.
(103) (21) 25°39.70'N., 080°06.85'W.
(104) (22) 25°45.00'N., 080°06.10'W.

(105) **In the Vicinity of Key West Harbor.**–Reference NOS chart 11434.

(106) (23) 24°27.95'N., 081°48.65'W.
(107) (24) 24°23.00'N., 081°53.50'W.
(108) (25) 24°26.60'N., 081°58.50'W.
(109) (26) 24°27.75'N., 081°55.70'W.
(110) (28) 24°29.35'N., 081°50.00'W.
(111) (29) 24°27.95'N., 081°48.65'W.

(112) **Area Surrounding the Marquesas Keys.**–Reference NOS chart 11434. (The Marquesas Keys are discussed in United States Coast Pilot 5.)

(113) (30) 24°26.60'N., 081°59.55'W.

(114) (31) 24°23.00'N., 082°03.50'W.
(115) (32) 24°23.60'N., 082°27.80'W.
(116) (33) 24°34.50'N., 082°37.50'W.
(117) (34) 24°43.00'N., 082°26.50'W.
(118) (35) 24°38.31'N., 081°54.06'W.
(119) (36) 24°37.91'N., 081°53.40'W.
(120) (37) 24°36.15'N., 081°51.78'W.
(121) (38) 24°34.40'N., 081°50.60'W.
(122) (39) 24°33.44'N., 081°49.73'W.
(123) (40) 24°31.20'N., 081°52.10'W.
(124) (41) 24°28.70'N., 081°56.80'W.
(125) (42) 24°26.60'N., 081°59.55'W.

(126) **Area Surrounding Dry Tortugas.**–Reference NOS chart 11434. (Dry Tortugas is described in United States Coast Pilot 5.)

(127) (43) 24°32.00'N., 082°53.50'W.
(128) (44) 24°32.00'N., 083°00.05'W.
(129) (45) 24°39.70'N., 083°00.05'W.
(130) (46) 24°45.60'N., 082°54.40'W.
(131) (47) 24°45.60'N., 082°47.02'W.
(132) (48) 24°42.80'N., 082°43.90'W.
(133) (49) 24°39.50'N., 082°43.90'W.
(134) (50) 24°35.60'N., 082°46.40'W.
(135) (51) 24°32.00'N., 082°53.50'W.

(136) **Northern right whales** are the world's most endangered large whale. The largest population, perhaps fewer than 300 animals, occurs along the east coast of the United States and Canada. Because right whales rest and nurse their young at the surface, and calves are unable to dive deeply, and often do not move out of the way of oncoming ships, they are highly vulnerable to being struck by ships. Ship strikes are one of the known sources of human-related mortality of right whales. Two of the best documented ship strikes involved whales struck and killed by vessels steaming in excess of 14 knots. One vessel was steaming in clear weather and calm seas, just before dusk, and well off the Mid-Atlantic coast, when a small pod a whales surfaced 50 yards off the starboard bow. A juvenile with the pod, was struck by the ship's propellers and killed. The second vessel was steaming in thick fog, inshore off the southeast coast in early January, when striking a juvenile, apparently dead-on.

(137) *Seasonal occurrence of northern right whales:* In seasons and in areas that right whales may occur, vessel operators should maintain a sharp lookout for right whales. Coastal waters off Georgia and northeastern Florida are the species' only known calving grounds; the calving season is generally December through March. In March and April, right whales accompanied by calves migrate northward, often within 20 miles of the coast to summer feeding grounds off New England. Seasonal right whale advisories and sighting reports are broadcast periodically for these areas by Coast Guard Broadcast Notice to Mariners, NAVTEX, and other means.

(138) *Description of northern right whale:* The species reaches lengths of 45 to 55 feet and is black in color. The best field identification marks are a broad back with no dorsal fin, irregular bumpy white patches (callosities) on the head, and a distinctive two-column V-Shaped blow. They have paddle-like flippers nearly as wide as they are long, and a broad, deeply notched tail, see diagrams following.

(139) *Early Warning System:* As weather and conditions permit, a dedicated seasonal-program of overflights and vessel surveys from Savannah River, Georgia south to Sebastian Inlet, Florida provide whale sighting information to the Coast Guard and others for broadcast purposes. Many right whales however, go undetected.

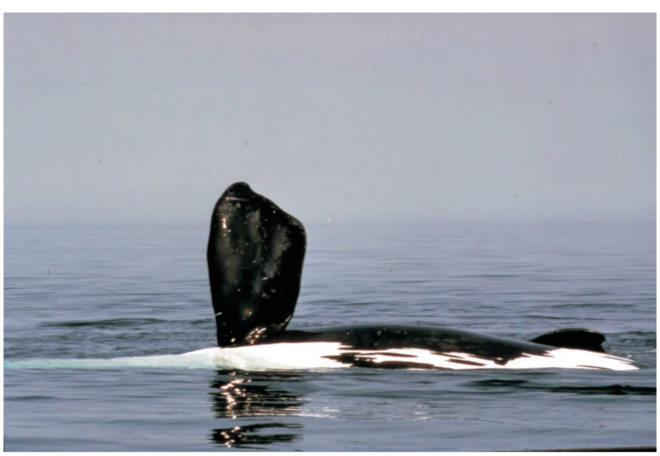
(140) *Precautions:* The National Marine Fisheries Service-appointed Southeast Implementation Team recommends the following precautionary measures be taken to avoid northern right whales. Consult with local pilots' association for additional precautionary measures.

When transiting right whale critical habitat during right whale calving season:

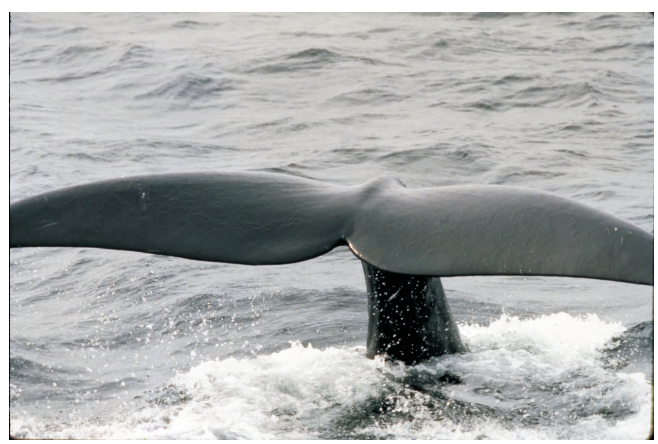
(141) As soon as possible prior to entering right whale critical habitat, check Coast Guard Broadcasts Notice to Mariners, NAVTEX, and other sources for recent right whale sighting reports.

(142) To the extent possible, review right whale identification materials and maintain a sharp watch with lookouts familiar with spotting whales.

(143) If a right whale is reported within 20 nautical miles of a ship's position within the previous 24 hours, mariners should

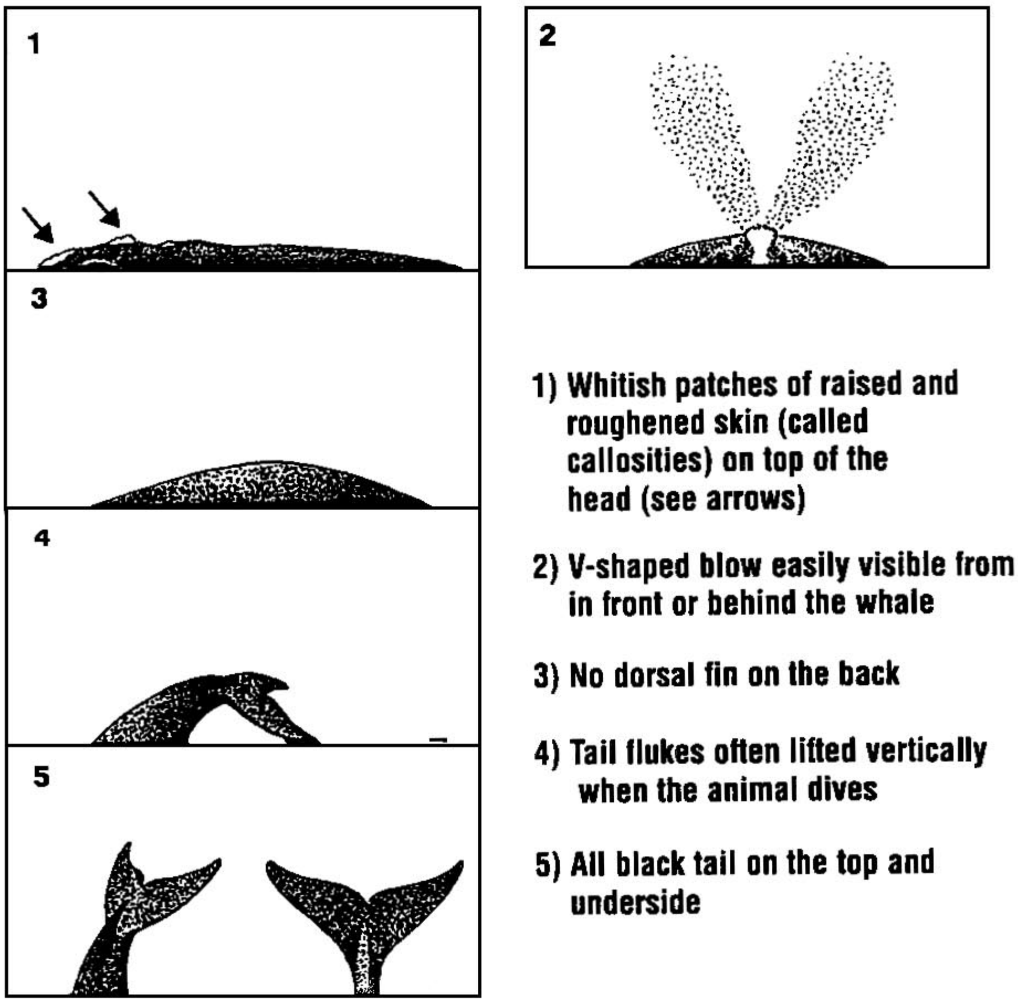


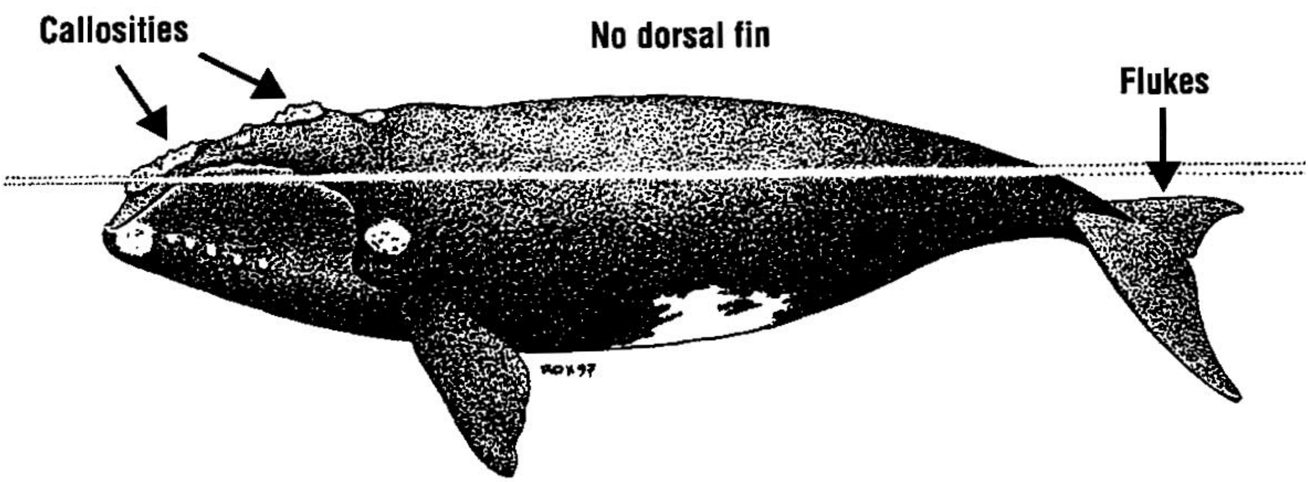
The right whales' unique paddle-shape flipers



Note the right whales' deeply notched tail fluke

Northern right whale





exercise caution and proceed at a safe speed, bearing in mind that reduced speed may minimize the risk of ship strikes. Consult with local pilots for additional precautions.

(144) Whenever practical, minimize travel distances through the critical habitats.

(145) When the ability to spot whales is reduced (e.g. night, fog, rain, etc.), mariners should bear in mind that reduced speed may minimize the risk of ship strikes.

(146) Local ships' pilots may also provide additional information on the location of right whales and local safe vessel operating procedures.

In all coastal and offshore waters along the east coast:

(147) If a right whale sighting is reported within 20 nautical miles of a ship's position, post a lookout familiar with spotting whales.

(148) If a right whale is sighted from the ship, or reported along the intended track of a large vessel, mariners should exercise caution and proceed at a safe speed within a few miles of the sighting location, bearing in mind that reduced speed may minimize the risk of ship strikes.

(149) When planning passage along the southeast coast attempt to avoid transit through right whale critical habitat during calving season by remaining offshore, and plan to minimize travel distances through the critical habitat when entering or leaving port.

(150) Do not assume right whales will move out of your way. Right whales are generally slow moving and seldom travel faster than 5-6 knots. Consistent with safe navigation, maneuver around observed right whales or recently reported sighting locations. It is illegal to approach closer than 500-yards of any right whale (see **50 CFR 222.32**, chapter 2 for limits, regulations and exceptions).

(151) Any whale accidentally struck, any dead whale carcass, and any whale observed entangled should be reported immediately to the Coast Guard noting the precise location, date, and time of the accident or sighting. In the event of a strike or sighting, the following information should be provided to the Coast Guard:

(152) location, date, and time of the accident or sighting or of a carcass or entangled whale,

(153) speed of the vessel,

(154) size of the vessel,

(155) water depth,

(156) wind speed and direction,

(157) description of the impact,

(158) fate of the animal, and

(159) species and size, if known.

(160) Right whales can occur anywhere along the east coast. Therefore, mariners are urged to exercise prudent seamanship in their efforts to avoid right whales.

(161) **Mandatory Ship Reporting Systems (WHALESNORTH and WHALESSOUTH)**, Mandatory Ship Reporting (MSR) systems require all vessels, 300 gross tons or greater, to report to the U.S. Coast Guard prior to entering two designated reporting areas off the east coast of the United States. (See **33 CFR 169**, chapter 2, for limits and regulations.) Sovereign immune vessels are exempt from the requirement to report, but are encouraged to participate.

(162) The two reporting systems will operate independently of each other. The system in the northeastern United States will operate year round and the system in the southeastern United States will operate each year from November 15 through April 15. Reporting ships are only required to make reports when entering a reporting area during a single voyage (that is, a voyage in which a ship is in the area). Ships are not required to report when leaving a port in the reporting area nor when exiting the system.

(163) Vessels shall make reports in accordance with the format in IMO Resolution A.858 (20) in accordance with the International Convention for the Safety of Life at Sea 1974 (SOLAS 74). (See 33 CFR 169.135 and 169.140, chapter 2, for additional information.) Vessels should report via INMARSAT C or via alternate satellite communications to one of the following addresses:

(164) Email: RightWhale.MSR@noaa.gov or Telex: 236737831

(165) Vessels not equipped with INMARSAT C or Telex should submit reports to the U.S. Coast Guard's Communication Area Master Station Atlantic (CAMSLANT) via narrow band direct printing (SITOR) or HF voice. Vessels equipped only with VHF-FM voice communications should submit reports to the nearest U.S. Coast Guard activity or group.

(166) Example Reports:

(167) **WHALESNORTH** - To: RightWhale.MSR@noaa.gov

(168) WHALESNORTH//

(169) M/487654321//

(170) A/CALYPSO/NRUS//

(171) B/031401Z APR//

(172) E/345//

(173) F/15.5//

(174) H/031410Z APR/4104N/06918W//

(175) I/BOSTON/032345Z APR//

(176) L/WP/4104N/06918W/15.5.//

(177) L/WP/4210N/06952W/15.5//

(178) L/WP/4230N/07006W/15.5//

(179) **WHALESSOUTH** - To: RightWhale.MSR@noaa.gov

(180) WHALESSOUTH//

(181) M/412345678//

(182) A/BEAGLE/NVES//

(183) B/270810Z MAR//

(184) E/250//

(185) F/17.0//

(186) H/270810Z MAR/3030N/08052W//

(187) I/MAYPORT/271215Z MAR//

(188) L/RL/17.0//

(189) **Inside Navigation.**–Navigation on the waterways covered by this volume requires a knowledge of the channel conditions and other factors restricting navigation. General items of interest to the vessel operator are indicated in the paragraphs that follow; details are given in the text.

(190) **Speed.**–Regulations are given in **162.65,** chapter 2.

(191) **Bends or Curves.**–In the Intracoastal and adjoining waterways there are many sharp bends which are dangerous to vessels meeting or passing. On approaching a bend, a vessel should reduce speed sufficiently to be able to stop within half the distance to a ship coming from the opposite direction. Under no circumstances should a vessel attempt to overtake and pass another at a bend. Even with sufficient view of the channel ahead and after proper exchange and understanding of signals, the overtaken

vessel may suddenly sheer from current action. This is even more pronounced with larger vessels and tows.

(192) **Crosscurrents.–**Where two streams cross, the current will have a greater velocity in the deeper channel. This is noticeable along the Intracoastal Waterway where it follows a dredged canal cutting across a winding stream. Crosscurrents will also be noticed where either an inlet from the ocean or a drainage canal enter the waterway.

(193) Crosscurrents are especially strong at New River Inlet and Bogue Inlet, N.C. Failure to allow for cross currents when passing these and other inlets is the cause of many rescue calls to the Coast Guard.

(194) **Spoil banks.–**Nature quickly covers her scars. This is true of the spoil banks made by dredging. In the northern areas when awash these banks are often covered by grass, while in the southern areas they are covered by bushes and sometimes fairly large trees.

(195) **Water hyacinth** is a floating freshwater plant which infests numerous streams tributary to the South Atlantic and Gulf coasts. It has bright green leaves and a purple flower. It propagates from seeds and suckers, spreads quickly in most localities, and may cause complete suspension of navigation if not removed. The hyacinths form in mats or jams and float around driven by the wind or current. In open water these mats often resemble small islands. At times some of the bays and tributaries may be changed in appearance because of hyacinth jams. Where the water is apt to be brackish, an attempt can be made to force a boat through the mat. In doing so, however, care should be taken that any logs that might be floating in the weeds are not struck with force enough to damage the hull. Snakes may also be found on the hyacinth mats. The work of removing this growth is undertaken by the various Corps of Engineers districts and the State of Florida by the processes of spraying, cutting, and the use of booms.

(196) **Mangrove.–**Three distinct types of mangrove are found in the southern section of this area. Yellow or white mangrove grows to a height of about 4 feet and is found principally on the sand flats in front of the fast land. Along the shores of Biscayne Bay, the red mangroves commonly grow to a height of 20 to 30 feet, with occasional stands 40 to 50 feet tall along the mainland coast south of Miami. Along the shores of Florida Bay, red mangroves generally grow 10 to 15 feet tall, but occasionally grow to 25 feet. They are rooted in water most of the time. Black mangrove grows on sand ridges and higher ground which cover only at very high water or storm tides. The black mangrove sometimes grows to a height of 50 to 60 feet.

(197) **Stumps and sunken logs.–**Reports are frequently made that vessels have struck shoals or rocks in rivers which have later proved to be stumps or sunken logs. Mariners are warned against navigating too close to the banks of streams where submerged stumps are known or may be expected to exist.

(198) **Hurricane moorings.–**On receiving advisory notice of a tropical disturbance small boats should seek shelter in a small winding stream whose banks are lined with trees, preferably cedar or mangrove. Moor with bow and stern lines fastened to the lower branches; if possible snug up with good chafing gear. The knees of the trees will act as fenders and the branches, having more give than the trunks, will ease the shocks of the heavy gusts. If the banks are lined only with small trees or large shrubs, use clumps of them within each hawser loop. Keep clear of any tall pines as they generally have shallow roots and are more apt to be blown down.

(199) **Manatees.–**The West Indian Manatee is a marine mammal protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. These acts make it illegal to harass, hunt, capture, or kill any marine mammal. The manatee is a large slow-moving herbivorous animal that resembles a blunt-nosed, stubby-flippered seal. These animals mainly inhabit the waters of Florida, although they have been sighted from south Virginia around the Gulf coast to Texas. They are quite docile and have no natural enemies, but are an endangered species, mostly because collisions with boat propellors cause a large number of deaths each year. In the winter, manatees move from the cooler waters of the Atlantic Ocean and the Gulf of Mexico and congregate, sometimes in large numbers, in warmer freshwater rivers and streams and near the cooling water discharge outlets of powerplants. It is during these high concentration periods that most manatee deaths occur.

(200) The Florida Manatee Sanctuary Act has been established to regulate motorboat speeds and operations in critical areas of manatee concentration between November 15 and March 31. The **regulated zones** are marked by large reflective signs. In these zones, boat operators must reduce their speed to "slow" or "idle", and no person shall intentionally or negligently annoy, molest, harass, disturb, collide with, injure, or harm manatees. Copies of the regulations are available from the Florida Department of Natural Resources, Division of Marine Resources, 3900 Commonwealth Blvd., Tallahassee, FL 32399. **Regulated zones** within the area covered by this Coast Pilot are in the St. Johns River at the confluence with Blue Springs Run; in the Caloosahatchee River from San Carlos Bay to the Edison Memorial Bridge (U.S. 41); in the Orange River and at its confluence with Caloosahatchee River; in Turkey Creek off Indian River; in the Indian River from St. Lucie Inlet to Jupiter Inlet and in the vicinity of powerplants at Delespine, Frontenac, Vero Beach, and Fort Pierce; in Lake Worth in the vicinity of the powerplant at Rivera Beach, the entire Port Everglades turning basin west of the line between Light 11 and Light 12 and south along the Intracoastal Waterway through and including the Dania Cut-off Canal.

(201) The U.S. Fish and Wildlife Service has established **regulated zones** within the Merritt Island National Wildlife Refuge to protect the large number of manatees that occupy these waters from April through mid-November. "Idle speed" and/or "slow speed/minimum wake" areas are in Haulover Canal, Bairs Cove on the southeast side of Haulover Canal, Banana Creek at the north end of Merritt Island, and in the channel and basin at the Kennedy Athletic and Recreation Society marina on the west side of Banana River 1.5 miles north of Canaveral Barge Canal. The area on the east side of Banana River immediately south of the NASA Parkway is closed to all motorized craft from April 1 through November 14 annually. The **regulated zones** are well marked by signs that indicate the speed limit. The regulations are contained in **50 CFR 26** (not carried in this Coast Pilot). Maps delineating the **regulated zones** are available from the Merritt Island National Wildlife Refuge, P.O. Box 6504, Titusville, Fla. 32780.

(202) **Tides.–**On the outer coast the mean range of tide increases from 2.8 feet at Cape Henry to 5.9 feet at Edisto Beach. In the sounds and rivers south to Florida the range is generally greater, reaching 8.0 feet or more at some locations. Along the east coast of Florida the average tide range is about 2.5 feet, and in the Florida Keys the ranges vary from 0.2 feet to 2.4 feet. (See Tide Tables for more detailed information.)

(203) **Currents.–**It appears that, except during northerly and northeasterly winds, a current of about 0.5 knot average velocity, setting northeastward with the trend of the coast, may be expected outside the 10-fathom curve between Cape Canaveral and Cape Hatteras. Farther offshore the velocity of the northeastward flow increases as the axis of the Gulf Stream is approached.

(204) Strong currents are produced by the wind along the coast during northeasterly and southerly gales, reversing or greatly increasing the normal current. Their velocity and direction depend upon the direction, strength, and duration of the wind. (See the Tidal Current Tables for detailed information.)

(205) The **Gulf Stream System** is the most famous of the principal ocean currents. The name was first used by Benjamin Franklin in 1769. In general, as the swift current of the Gulf Stream issues into the sea through Straits of Florida, its waters are characterized by a deep blue color, high-salinity, high temperature in the upper stratum, and presence of phosphorescence. Except near shoals where waves may stir up bottom sediments, Gulf Stream water is very clear, enabling visual penetration to unusually great depths. At its junction with coastal seawater, the edges may frequently be recognized in moderate weather by ripples, as well as by the difference in color. Northward, in the cooler regions, the evaporation from its surface, when the temperature of the air is lower than that of the water, is apparent as "sea smoke." In addition, the stream may carry with it some **Gulf weed** (Sargassum), which is olive brown, branched seaweed with berrylike air vessels.

(206) The upstream extent of the Gulf Stream System can be traced to the Yucatan Strait where a well-established current enters the Gulf of Mexico. The current in the Gulf of Mexico is called the **Loop Current.** The position of the Loop Current is quite variable, but there is some evidence of a cyclical pattern of about 290 days. The Loop Current begins with a short flow pattern protruding into the Gulf of Mexico, then it slowly builds up, gradually protruding northward and westward into the Gulf and reaching as far as 28°N and 90°W before shedding a large warm ring. The remaining Loop Current has a shortened flow path and begins the process anew. The large detached warm ring will drift about 1.5 miles per day west to southwestward into the western Gulf of Mexico where it will eventually dissipate. Gulf of Mexico warm rings average about 120 miles in diameter. The warm ring has a clockwise flow with a maximum current close inside its periphery of 0.5 to 1.5 knots.

(207) After entering the Straits of Florida between Cuba and the Florida Keys, the Gulf Stream System's path becomes much more stable. The major variation of the current from off Key West to off Little Bahama Bank appears to be a meandering of the axis of the current within the narrow confines of the Straits. The current within the Straits and slightly to the north is frequently referred to as the **Florida Current.**

(208) Shortly after emerging from the Straits of Florida, the Gulf Stream is joined by the **Antilles Current,** which flows northwesterly along the open ocean side of the West Indies. The Antilles Current, like the Gulf Stream, carries warm, highly saline waters of clear indigo blue. The union of the two currents gives rise to a broad and deep current possessing about the same characteristics as the Florida Current except that the velocity is somewhat reduced. The Gulf Stream from the Florida Straits flows northward, then northeastward, paralleling the general trend of the 100-fathom contour up to Cape Hatteras. From 32°N to Cape Hatteras the stream shows some lateral meandering which does not generally exceed one stream width, or about 40 miles.

(209) Beyond Cape Hatteras the Gulf Stream flows eastward away from the coast and into much deeper water. As it moves into progressively deeper water, the stream is subject to increased meandering which can have as large a north-south extent as 270 miles. The wavelike meanders of the stream propagate eastward at speeds of about 3 to 5 miles per day. These meanders occasionally shed detached current rings or eddies which are found north and south of the stream and which are respectively warmer and cooler than the surrounding waters. Rings are generally formed east of 65°W.

(210) Warm rings average about 70 miles in diameter and are found north of the stream between it and the continental shelf. Warm rings rotate in a clockwise direction with a maximum flow of about 1.6 knots located about 2/3-3/4 from the center of the eddy. Warm rings generally move about 1.5 miles per day westward after formation in the region between the stream and the continental shelf to about 70°W. From 70°W the rings generally move southwestward along the continental shelf and eventually are absorbed into the stream near Cape Hatteras. Many warm rings are absorbed by the stream well before they reach Cape Hatteras. About 20 warm rings are formed each year and average about a 20-week life cycle. Cold rings average about 60 miles in diameter and are found south of the stream in the Sargasso water region. Cold rings rotate in a counterclockwise direction with a maximum flow of about 1.6 knots located 2/3-3/4 from the center. Cold ring velocities can be significantly higher than 1.6 knots. Cold rings tend to move about 1.5 miles per day southwestward after formation and are eventually absorbed back into the Gulf Stream. About 20 cold rings are formed each year and average about a 1.5 year life cycle.

(211) Eastward of the Grand Banks of Newfoundland, the whole surface is slowly driven eastward and northeastward by the prevailing westerly winds to the coastal waters of northwestern Europe. For distinction, this broad and variable wind-driven surface movement is sometimes referred to as the **North Atlantic Drift.**

(212) On its western or inner side, the Gulf Stream is separated from the coastal waters by a zone of rapidly falling temperature, to which the term **north wall** (**west wall** from Georgia south) has been applied. The abrupt change in the temperature of the waters separated by the north wall (west wall) is frequently very striking and is a definite indication of the edge of the stream. It is most clearly marked north of Cape Hatteras but extends, more or less well defined, from the Straits of Florida to the Grand Banks of Newfoundland. In the vicinity of the Grand Banks, the north wall represents the dividing line between the warm current of the Gulf Stream and the cold waters of the **Labrador Current,** which according to observations, turns sharply, between 42°-43°N and 51°-52°W, and flows parallel to the Gulf Stream.

(213) Throughout the whole stretch from the Florida Keys to past Cape Hatteras the stream flows with considerable velocity. Characteristic average surface speed is on the order of 2.5 knots, increasing to about 4.5 knots off Cape Florida where the cross sectional area of the channel is least. These values are for the axis of the stream where the current is a maximum, the speed of the stream decreasing gradually from the axis as the edges of the stream are approached. The axis of the stream is estimated to be about 3-15 miles seaward of the north wall. Both the speed and

position of the axis of the stream fluctuate from day to day, hence description of both position and speed are averages.

(214) Crossing the stream at Jupiter or Fowey Rocks, an average allowance of 2.5 knots in a northerly direction should be made for the current.

(215) Crossing the stream from Habana, a fair allowance for the average current between 100-fathom curves is 1 knot in an east-northeasterly direction.

(216) A vessel bound from Cape Hatteras to Habana, or the Gulf ports, crosses the stream off Cape Hatteras. A fair allowance to make in crossing the stream is 1 to 1.5 knots in a northeasterly direction for a distance of 40 miles from the 100-fathom curve.

(217) Earlier systematic observations on the Gulf Stream dealt with the temperature of the water rather than its motion, and the axis was taken to be along the line of highest temperature obtained. Later the axis was taken to mark the line of greatest velocity. Ordinarily it is assumed that these two axes coincide, but this is by no means certain. The thermometer, although it indicates the limits of the stream in a general way, is therefore only an approximate guide to the velocity of the currents.

(218) The lateral boundaries of the current within the Straits of Florida are fairly well fixed, but as the stream crosses 32°N its eastern boundary becomes somewhat vague. On the western side the limits can be defined approximately since the waters of the stream differ in color, temperature, salinity, and flow from the inshore coastal waters. On the east, however, the Antilles Current combines with the Gulf Stream so that its waters here merge gradually with the waters of the open Atlantic. Observations of the National Ocean Service indicate that, in general, the average position of the inner edge of the Gulf Stream from the Straits of Florida to Cape Hatteras lies inside the 100-fathom curve.

(219) At the western end of the Straits of Florida the limits of the Gulf Stream are not well defined. Between Fowey Rocks and Jupiter Inlet the inner edge lies very close to the shoreline.

(220) Along the Florida Reefs between Alligator Reef and Dry Tortugas the distance of the northerly edge of the Gulf Stream from the edge of the reefs gradually increases toward the westward. Off Alligator Reef it is quite close inshore, while off Rebecca Shoal and Dry Tortugas it is possibly 15 to 20 miles south of the 100-fathom curve. Between the reefs and the northern edge of the Gulf Stream the currents are ordinarily tidal and are subject at all times to considerable modification by local winds and barometric conditions. This neutral zone varies in both length and breadth; it may extend along the reefs a greater or lesser distance than stated, and its width varies as the northern edge of the Gulf Stream approaches or recedes from the reefs.

(221) **Location of the Gulf Stream.**–The approximate position of the Gulf Stream for various regions is shown on the following NOS charts: 11013, Straits of Florida; 411, South Carolina to Cuba; 11460, Cape Canaveral to Key West; 11420, Alligator Reef to Habana. Chart 11009 shows the axis and the position of the inner edge of the Gulf Stream from Cape Hatteras to Straits of Florida.

(222) Up-to-date information on the location, width, and maximum surface temperature of the Gulf Stream System is available in a variety of ways. Such information is broadcast by NOAA Weather Radio stations from Key West, Florida, to Cape Hatteras, North Carolina. The times of these broadcasts and their formats vary from station to station, but in general, all give the distance to the inshore edge of the Stream with reference to a navigational light or buoy, the width of the Stream when that is known, and the maximum temperature. This information is derived largely from infrared satellite imagery, and it is unfortunately not available during the warmer summer months south of about Jupiter Inlet. (See Appendix for a list of NOAA Weather Radio stations.)

(223) For ships in port or with telecopy equipment, an analysis of the Gulf Stream System from the central Gulf of Mexico to Cape Hatteras which includes an estimated location of the maximum current is prepared on Mondays, Wednesdays, and Fridays by Tropical Storm Analysis Center, National Weather Service, NOAA, 1320 South Dixie Highway, Coral Gables, Fl 33146, 305-665-4707. These analysis are available to anyone with a telecopy receiver compatible with a Group 3 compatible automatic telecopier by simply telephoning 305-661-0738.

(224) An analysis of the Gulf Stream System from the western Gulf of Mexico to Cape Hatteras (South Panel) and from Cape Hatteras to Nova Scotia (North Panel) is prepared by Ocean Products Center, National Ocean Service, NOAA, World Weather Building, 5200 Auth Road, Washington, DC 20233, 301-763-8294.

(225) The North Panel is generated on Mondays, Wednesdays, and Fridays, while the South Panel is generated on Tuesdays and Thursdays. A subscription to these analysis is available upon application, to Satellite Data Services Branch, National Environmental Satellite, Data, and Information Service, World Weather Building, Room 100, 5200 Auth Road, Washington, DC 20233, 301-763-8111. These analysis are available via Xerox Model 410 automatic telecopier by telephoning 301-899-1139. They are also transmitted by KWX, Lewes, DE, via radiofax on 4223 kHz at 0645Z and 1845Z. Contact National Weather Service Forecast Office, Washington, DC, at 301-763-8088 or 8239, to ascertain any changes to the above telecopier and radiofax schedules.

(226) **Wind-driven currents** are very complicated. Their velocities and directions depend upon a number of factors such as the velocity, direction, and duration of the wind, the proximity of the coast and the direction of the coastline. Generally in the Northern Hemisphere the wind-driven current sets somewhat to the right of the wind, but in coastal waters there are many exceptions to this general rule, the current often setting to the left of the wind, due to the tendency of the current to follow the direction of the coastline or to other local conditions.

(227) The velocity of the wind current relative to that of the wind also varies with the locality. (See the Tidal Current Tables for information on wind-currents.)

(228) **Weather**.–From hurricanes to “Nor’easters” these coastal waters are plagued with potential weather hazards year-round. The Gulf Stream, local currents and numerous shoals complicate matters. The following text describes the weather problems that face the mariner. The individual chapters contain information on local weather hazards. Government radio stations that transmit weather information and National Weather Service offices are listed in the appendix. Climatological tables for coastal locations and ocean areas, compiled from ship observations, follow the appendix. This text was produced by the National Oceanographic Data Center.

(229) Coastal Warning Display locations are listed on NOS charts and shown on the Marine Weather Services Charts published by the National Weather Service. The Marine Weather Services Charts, which also show radio stations that transmit marine weather broadcasts and additional information of interest to mariners, are available from National Ocean Service, Distribution Branch (N/CG33). (See Appendix for address).

(230) **Extratropical Cyclones**.–One of the more frequent weather features the mariner encounters along the coast is the winter storm or "Nor'easter." These Extratropical systems can develop in any month. Their size can vary from an insignificant wave along a front to a gigantic circulation that covers most of the western North Atlantic. Winds can reach hurricane force and seas of 40 feet (12 m) and more have been encountered. While these storms are usually well forecasted they can develop or deepen explosively, particularly off Cape Hatteras, over the Gulf Stream, giving rise to the term "Hatteras Storms."

(231) These winter storms, present in all months, are most frequent and intense from November through March. December, January and February are the heart of the season, when an average of four to six storms per month roam these waters. Many systems develop in the Gulf of Mexico, move across central or northern Florida, then up the East Coast. Some of the most intense storms have developed early and late in the season. In March 1962 a slow moving, late winter coastal storm combined with spring tides and wrought tremendous destruction from Florida to New England. Persistent northeasterlies and a long fetch raised spring tides to near record levels and generated high seas in the open ocean. Several ships were caught, including a tanker which broke in two off Cape Hatteras. During the Veterans Day storm in November 1968 a ship near Ocracoke Inlet ran into 35-foot seas in 60-knot winds.

(232) In March 1993, the "Storm of the Century", a slow moving late winter coastal storm, combined with spring tides and wrought tremendous destruction from Florida to New England. From hurricane-type storm surge and winds along the upper Gulf Coast of Florida to record snowfalls in the southern and central Appalachians and a first-time-ever interruption of air travel at every airport east of the Mississippi, the March 1993 extra tropical low pressure system will be a storm long remembered.

(233) **Cold Fronts**.–These, often sharp, boundaries between relatively warm air ahead and cold air behind usually approach this coast from the west through north. Ahead of the front, winds are usually squally and often blow out of the south through southwest. Cirrus clouds give way to Altocumulus or Altostratus and Nimbostratus, then Cumulonimbus. Pressure falls moderately and showers, and perhaps thunderstorms, occur. Seas become choppy. With the frontal passage winds shift rapidly to the west and northwest. Strong gusts and squalls continue. Clearing usually occurs a short distance behind the front as the cold air moves in. Cold fronts can move through the northern part of the area quite rapidly. Their speeds vary from about 10 to 20 knots in summer up to 40 knots in winter. Often, cold fronts remain north of this coast. Their frequency decreases with latitude. During the winter season strong arctic and polar outbreaks occasionally push southward to Florida and in rare instances cold fronts reach the Florida Keys. In other seasons these outbreaks are not strong enough to reach the southern part of this coast.

(234) During the spring and summer when the air ahead of the cold front may be very unstable, a line of thunderstorms, known as a squall line, may develop. These instability lines can form 50 to 300 miles (93 to 555 km) ahead of a fast moving front. They may even contain tornadoes or waterspouts. These storms can inflict considerable damage on fishing vessels and small craft.

(235) **Tropical Cyclones**.–A tropical cyclone is a warm core, low pressure system that develops over tropical oceans. It exhibits a rotary, counterclockwise circulation in the Northern Hemisphere around a center or "eye." In small tropical cyclones the diameter of the area of destructive winds may not exceed 25 miles (46 km) while in the greatest storms the diameter may reach 500 miles (925 km). At the center is a comparatively calm, sometimes clear, area known as the eye. The diameter of the eye can vary from about 5 to 25 miles (9 to 46 km). Winds are usually strongest near the center. They can reach 175 knots or more in an intense hurricane. In the North Atlantic Region (West Indies, Caribbean Sea, Gulf of Mexico and waters off the U.S. east coast) the following terminology is used in tropical cyclone warnings issued by the National Hurricane Center (National Weather Service):

(236) (1) Tropical Depression. A tropical cyclone in which the maximum sustained surface wind (1-minute mean) is 33 knots or less.

(237) (2) Tropical Storm. A tropical cyclone in which the maximum sustained surface wind (1-minute mean) ranges from 34 knots to 63 knots.

(238) (3) Hurricane. A tropical cyclone in which the maximum sustained surface wind (1-minute mean) is 64 knots or more.

(239) While the following term is not normally used in tropical cyclone advisories it may appear in related products.

(240) Tropical Wave–A minor cyclonic circulation in the easterly tradewinds, which could develop into a tropical depression but lacks evidence of a closed circulation; also known as easterly wave.

(241) With the advances in observations through satellite, a hybrid storm, called a subtropical cyclone, has been discovered. The character of this storm lies between the tropical and Extratropical cyclone. It is often short lived and dissipates without developing beyond the depression stage. Those that intensify occasionally change character and become tropical storms or hurricanes. While subtropical they are designated as a depression or storm (no upper wind limit) similar to tropical systems.

(242) Along the coast greater damage may be inflicted by water than by wind. Prolonged winds blowing toward shore can increase water levels from about 3 to 10 feet (1 to 3 m) above normal. This storm tide may begin when the tropical cyclone center is 500 miles (925 km) or more away. It gradually increases until the winds change direction. On top of this the low pressure in the storm's center can create a ridge or wall of water known as a surge. This will move in the direction of the storm's movement and can be disastrous. The effect may be similar to that of a tsunami (seismic sea wave) caused by earthquakes in the ocean floor. Storm surges can push these tides to 20 feet (6 m) or more above normal. About 3 or 4 feet (.9 or 1.2 m) of this is due to the decrease of atmospheric pressure and the rest to the strong winds. Additional water damage results from the pounding of sea and swell. Torrential rains, generated by tropical cyclones, can cause both flash floods and river floods from inland rains.

(243) **Tropical cyclone climatology**.–In an average season nine or ten tropical cyclones develop and five of these reach hurricane strength; about two hurricanes reach the U.S. While they may develop in any month, June through November is generally considered the tropical cyclone season, with a peak in August, September and October. Early and pre-season storms, from May through mid-July, are most likely to originate in the western Caribbean Sea and Gulf of Mexico. From mid-July through late September this development is spread through the main basin of the tropical Atlantic and a much more persistent westerly movement is noticeable. From late September through November, activity gradually confines itself to the Caribbean and Gulf of Mexico. A northerly movement, similar to early season storms, becomes

more apparent. However, because of the large reservoir of heat available at the end of the season, these storms are often more intense than their early season counterparts.

(244) The most common path is curved, the storms first moving in a general westward direction, turning later to the northwestward and finally toward the northeast. A considerable number, however, remain in low latitudes and do not turn appreciably toward the north. Freak movements are not uncommon, and there have been storms that described loops, hairpin-curved paths, and other irregular patterns. Movement toward the southeast is rare, and, in any case, of short duration. The entire Caribbean area, the Gulf of Mexico, the coastal regions bordering these bodies of water, and the Atlantic coast are subject to these storms during the hurricane season.

(245) The average speed of movement of tropical cyclones is about 10 to 15 knots. This speed, however, varies considerably according to the storm's location, development, and the associated surface and upper air patterns. The highest rates of speed usually occur in the middle and higher latitudes and range up to 40 to 50 knots. Storms are slowest during recurvature or when looping. They can also become stationary in the absence of steering currents.

(246) **Hurricane Warnings and Forecasts**.–The civilian hurricane warning service for the North Atlantic is provided by the National Hurricane Center/Tropical Prediction Center, Miami, Florida. They collate ship, aircraft, radar and satellite data to produce and issue tropical cyclone warnings and forecasts for the North Atlantic Ocean, including the Caribbean Sea and Gulf of Mexico. The principal product is the Tropical Cyclone Advisory message especially tailored for marine, aviation, military and public interests. They are issued every 6 hours with intermediate bulletins provided when needed.

(247) For tropical storms and hurricanes threatening to cross the coast of the U.S., coastal warnings are issued to the public by the National Hurricane Center through local Hurricane Warning Offices in order that defense against damage, and perhaps evacuation, can be implemented. Two levels of warnings are employed. The "Hurricane Watch" is a preliminary alert that a hurricane may threaten a specified portion of the coast. It is issued approximately 36 hours before landfalls could occur. The second level is the "Hurricane Warning", which indicates that hurricane conditions are expected within 24 hours in advance of landfall. It is aimed at providing the best compromise between timeliness and accuracy for civil defense purposes so that its warning may be too late to allow ocean-going vessels to get underway and complete a successful evasion in open water. To compensate for this, the Marine Advisory contains additional guidance in the form of probabilities of hurricane strikes, for coastal locations and even offshore coordinates, and storm position forecasts for up to 72 hours in advance.

(248) **Hurricane Havens**.–The text for this section has been condensed from the **Hurricane Havens Handbook for the Atlantic Ocean** published by the Naval Environmental Prediction Research Facility at Monterey, Calif. The navigation information may be applied to extratropical cyclones as well. Summaries for individual ports, where available, can be found in the appropriate chapters. The complete publication is available through the National Technical Information Service, Springfield, Virginia 22161 (http://www.ntis.gov).

(249) The classical doctrine held by most mariners is that ocean-going ships should leave ports that are threatened by a hurricane. Despite this natural caution, ships continue to be damaged in port or after leaving port, as a result of tropical cyclone encounters. This often stems from the difficulty in forecasting tropical cyclone movement, although these forecasts have improved significantly in the past two decades. In addition to evaluating the forecast it is necessary to assess the risks of remaining in port or putting to sea according to the circumstances of the threat, the facilities of the port and the capabilities of the vessel and crew. For an evaluation as to a course of action several factors are important. The risk of a particular port experiencing a hurricane is often dependent on seasonal and geographic influences. Forecasts of hurricane movements are more reliable in some areas, particularly the lower latitudes. In the midlatitudes where storms are often recurving, the difficulty increases. It is important to know the sheltering capabilities of the port that is being considered and the speed of advance of tropical cyclones in the latitudes that you may be sailing. When the tropical cyclone speeds approach or exceed vessel speed, options become limited.

(250) Large changes in the balance of these factors that may affect a leave/stay decision are evident all along the Atlantic coast. At Charleston, S.C. for example the threat of a hurricane is moderate as is the average forecast error. The speed of storm advance is relatively low for both average and extreme values. These factors suggest a relatively low risk of damage at sea if an evasion is executed as early as possible. Ports in the Mayport area have the potential of being fairly good hurricane havens despite their conspicuous lack of shelter, because of the rarity of serious hurricane threats and the prospects of a safe escape to sea when needed; this is due to the low speeds of advance of near-coastal storms and relatively low forecast error. Two ports with a high risk of hurricane threats, Key West and Morehead City, show a large contrast in the remaining leave/stay decision factors. Hurricanes at Key West appear predictable and easy to evade at sea. However, the combination of unpredictability and relatively high speed of advance of near-coastal storms affecting North Carolina, marks Morehead City as a less secure port to occupy during the hurricane season than Key West, and one from which evasion at sea carries a higher risk of damage.

(251) In the northeast, certain ports have the potential to offer good hurricane haven qualities because of the low risk of a hurricane threat in conjunction with topographic shelter. In addition the risk of misjudging the threat, due to relatively large forecast errors, is considerable. Furthermore, the risk of sustaining damage in attempting to evade at sea is increased by the usually, fast-moving storms. This combination should encourage mariners in this region to regard evasion at seas as a last resort.

(252) Along the U.S. Gulf of Mexico coast there is a reduced flexibility in evasion options created by the shape of the Gulf. This biases the leave/stay decision in favor of an early departure, which effectively reduces the accuracy of the threat prediction. The large range of possible speeds of storms affecting the coast from Pensacola to New Orleans should encourage even earlier departure. The net result is that Gulf ports should be considered "high risk" ports similar to Key West and Morehead City. Additionally, local factors in the Gulf area further diminish the security of many ports. For example, the strong impact of the storm surge, in many places, leads to the closure of ports due to sudden silting of their long, dredged approach channels.

(253) A sudden unexpected change in the speed or direction of movement of a tropical cyclone, or a change in its intensity, may call for a hasty departure from port in deteriorating weather.

(254) However, limitations in manpower, port tug facilities or the state of readiness of the ship's machinery will increase the risk of the vessel being damaged during departure. Furthermore, the chances of gaining sufficient sea room in heavy weather to avoid damage after leaving port, are also decreased. The odds for preventing serious damage to the vessel in these circumstances, swing in favor of using the resources available to secure the ship firmly to her berth. These measures should include laying anchors into the channel or basin to hold her away from the pier or wharf face. This is particularly important in preventing damage to both vessel and pier if storm tides flood the wharf. These tidal effects will require lines to the pier to be tended until the hurricane threat is well passed. Certain merchant vessels may also consider ballasting down if the bottom at the berth is likely to be clear of obstacles. Under pressure of these circumstances, proceeding to anchor or moor is a less attractive alternative unless both the resources to accomplish the move safely and the assurance of an authenticated hurricane mooring or anchorage, are available.

(255) Of the 81 tropical cyclones that threatened Cape Hatteras (came within 50 nautical miles (93 km)) during the period 1842-1995, 67 occurred during the months of August, September, and October. As with the entire Atlantic basin, the main threat is in September. Due to the location of the Cape, its' extension out into the Atlantic from the mainland, the predominate direction from which storms arrive is from the South or Southeast. Since 1950, 32 storms have come within 50 nm (93 km) of the Cape. Perhaps the two most memorable storms of recent times are hurricane Donna in 1960 and hurricane Gloria in 1985. Donna, in September 1960, came ashore near Morehead City with highest sustained winds of 95 knots and passed about 50 nm miles (93 km) west of Cape Hatteras while maintaining that intensity. Gloria passed directly over the Cape on September 27, 1985 with 90-knot winds. The maximum wind at Cape Point was 64 knots.

(256) Of the 60 tropical cyclones that threatened Charleston during the period 1842-1995, 46 occurred during the months August, September, and October. By far the greatest threat is in September. The predominate direction from which the storm arrives is from the Southwest and usually has weakened greatly since making initial landfall along the Gulf Coast and crossing several hundred miles (>450 km) of land. Since 1950, 23 storms have come within 50 nm (93 km) of Charleston. Perhaps the two most memorable storms of recent times are hurricane David in 1979 and hurricane Hugo in 1989. David came ashore near Savannah Beach, Georgia and raked the Charleston area with gusts of 85 knots. Ten years later, Hugo came ashore at Sullivans Island, just north of Charleston, with peak winds of 120 knots. Downtown Charleston reported winds of 76 knots with gusts to 94 knots while the airport had sustained winds of 68 knots with gusts to 85 knots. The maximum one-minute wind at Bulls Bay, near the point of impact, was estimated in excess of 120 knots.

(257) Of the 59 tropical cyclones that threatened Daytona Beach during the period 1842-1995, 47 occurred during the months August, September, and October. By a narrow margin, the greatest occurrence is in September. The predominate direction from which the storm arrives is from the South or Southwest. Since 1950, 22 storms have come within 50 nm of Daytona Beach. Hurricane Donna is likely the most memorable storm to effect the Daytona Beach area in recent memory. On September 11, 1960, Donna crossed the central Keys moving to the northwest and abruptly turned northward crossing the southwest Florida coast near Naples. From there, Donna continued north-northeastward, up the spine of the peninsula, moving back out over open water north of Daytona Beach. The maximum wind at landfall was estimated near 135 miles per hour (60 m/s) with gusts to 150 miles per hour (67 m/s) and winds were still 90 miles per hour (40 m/s) by the time the storm reached the Daytona Beach area.

(258) Of the 58 tropical cyclones that threatened Miami during the period 1842-1995, 52 occurred during the months August, September, and October. At this latitude, along with the proximity of the Caribbean Sea and much warmer water, October is the most likely month of occurrence. The predominate direction from which the storm arrives is from the south or southeast. Since 1950, 24 storms have come within 50 nm of Miami. Hurricane Cleo in 1964 and Hurricane Andrew in 1992 are likely the most noteworthy storms to affect Miami in recent memory. Hurricane Cleo was a very small storm and did little damage. It passed near Miami on August 27, 1964. It is perhaps most noteworthy due to it's punch. Maximum winds were 110 miles per hour (49 m/s) with gusts to 135 miles per hour (60 m/s). Hurricane Andrew passed just south of Miami on August 24, 1992. Andrew goes on record as being the storm having the third lowest air pressure at landfall of any storm in U.S. history. Andrew ravaged Homestead, Florida, in the early morning hours of August 24 with winds in excess of 150 knots on a path that took it across south Florida in four hours. Andrew ranks as the most costly natural disaster to date for the United States.

(259) **Tropical cyclones at sea**.–Few experiences rival that of encountering a full blown hurricane at sea. However, even if there were no transmitted advisories, nature provides its own tropical warnings. Several days before its arrival, the hurricane heralds its existence. Swells that were passing the ship at ten to fifteen per minute increase in length and now pass at about two to five per minute. The direction from which they arrive marks the relative bearing of the storm. A second rough fix may be obtained by adding 115° (Northern Hemisphere) to the direction from which the wind is blowing. Another indicator is the barometer. In the tropics there is a normal rise and fall of barometric pressure with the high points at about 1000 and 2100 LST. When the storm is 500 to 1,000 miles (925 to 1850 km) away the barometer may rise slightly and then a pumping action may begin. When it starts a steady fall, activity is brewing. When the storm is about 300 to 600 miles (555 to 1110 km), away white, fibrous, cirrus clouds ("mare's tails") appear in a nearly cloudless sky. These seem to converge in the direction from which the storm is approaching, particularly at sunrise and sunset. The barometer continues to fall. The cirrus gives way to a veil of cirrostratus followed by altostratus, then stratocumulus. Mist-like rain is interrupted by an occasional shower as the barometer drops about 4 millibars. Winds become gusty and increase to about 22 to 40 knots. On the horizon appears a dark wall of heavy cumulonimbus, the bar of the storm. Portions of this cloud occasionally break off and drift across the sky accompanied by gusty rain squalls. As the bar approaches, from the direction of the storm's center, the barometer falls more rapidly. Windspeeds increase. Seas become steeper. Squall lines sweep past in ever-increasing number and intensity. The arrival of the bar is accompanied by dark skies, nearly-continuous squalls, a steep-falling barometer and rapidly increasing winds. The hurricane center may still be 100 miles (185 km) away. As the center approaches, winds whip through

the superstructure. Seas become mountainous. Wave tops are blown off to mingle with torrential rain that fills the air with water. Visibility drops to near zero. Survival becomes the prime consideration.

(260) The eye brings a sudden drop in winds. Rain stops and skies may clear enough to see the sun. Mountainous seas approach from all sides. The barometer reaches its lowest point which may be 50 to 100 millibars below normal. As the wall cloud on the opposite side of the eye arrives, the full fury of the storm returns as suddenly as it ceased, with winds blowing from the opposite direction. The sequence of conditions is reversed and passes more quickly as the circulation is usually smaller in the rear of the storm.

(261) **Maneuvering for a tropical cyclone**.–Knowledge is the most important aid when a tropical cyclone is threatening. It is vital to know the storm's position, intensity, projected movement and how to react to this information. By plotting the center as provided in the warnings, possibly even adjusting its position with a radar fix or local signs, its position in relation to the vessel can be determined.

(262) Shipboard radar provides the mariner with an advantage and if radio-facsimile charts are available the advantage is even greater. The mariner is even more fortunate if his ship has the appropriate satellite receiving-recorder, either facsimile or photographic, to position the cloud patterns of the storm as it moves. If, despite warning systems and forecasts, a storm catches up with the ship, prepare for the worst.

(263) There are three major schools of thought concerning ship handling in hurricanes. They may be described as active, passive and defensive:

(264) Active: Take an evasive course and get out of the storm.

(265) Passive: Shut down and wallow.

(266) Defensive: Just maintain steerageway, keeping the wind and seas either off the bow or the quarter.

(267) The course of action will depend on the size and intensity of the storm, the nature and condition of the ship, the proximity to shoal water, and other factors which can only be determined by the master. While the vessel can still make considerable way through the water, a course should be selected to take it as far as possible from the center. If the vessel can move faster than the storm, it is a relatively simple matter to outrun the storm if sea room permits. But when the storm is faster, the solution is not as simple. In this case, the vessel, if ahead of the storm, will pass closer to the center. The problem is to select a course that will produce the greatest possible minimum distance. This is best determined by means of a relative movement plot.

(268) In the Northern Hemisphere, that part of the circulation to the right of the storm track (facing in the direction toward which the storm is moving) is called the dangerous semicircle. It is considered dangerous because (1) the actual wind speed is greater than that due to the pressure gradient alone, since it is augmented by the forward motion of the storm, and (2) the direction of the wind and sea is such as to carry a vessel into the path of the storm (in the forward part of the semicircle). The circulation to the left of the storm track is known as the navigable semicircle, where the wind is slowed by the storm's motion and vessels are pushed away from the path. Seas are usually lower in this portion. In an ideal situation the following general guidelines could be used:

(269) **Right or dangerous semicircle**.–Bring the wind broad on the starboard bow (045° relative), hold course, and make as much way as possible. If obliged to heave to, do so with head to the sea.

(270) **Left or navigable semicircle**.–Bring the wind onto the starboard quarter (135° relative), hold course, and make as much way as possible. If obliged to heave to, do so with stern to the sea.

(271) **On storm track, ahead of center**.–Bring the wind two points abaft the starboard quarter (157½° relative), hold course, and make as much way as possible. When well within the navigable semicircle, maneuver as indicated above.

(272) **On storm track, behind center**.–Avoid the center by the best practical course, keeping in mind the tendency of tropical cyclones to curve northward and eastward.

(273) If the storm maintains its direction and speed, the ship's course should be maintained as the wind shifts. In all cases, one should be alert to changes in the direction of movement of the storm center, particularly in the area where the track normally curves toward the north.

(274) If it becomes necessary for a vessel to heave to, the characteristics of the vessel should be considered. A ship is concerned primarily with damage by direct action of the sea. A good general rule is to heave to with head to the sea in the dangerous semicircle or stern to the sea in the navigable semicircle. This will result in the greatest amount of headway from the storm center, and the least amount of leeway toward it. If a vessel handles better with the sea astern or on the quarter, it may be placed in this position in the navigable semicircle or in the rear half of the dangerous semicircle; movement should be slow. It has been reported that when the wind reaches hurricane speed and the seas become confused, some ships ride out the storm best if the engines are stopped, and the vessel is permitted to seek its own position. In this way, it is said, the ship rides with the storm instead of fighting against it.

(275) In a sailing vessel, while attempting to avoid a storm center, one should steer courses as near as possible to those prescribed above for power vessels. However, if it becomes necessary for such a vessel to heave to, the wind is of greater concern than the sea. A good general rule always is to heave to on whichever tack permits the shifting wind to draw aft. In the Northern Hemisphere this is the starboard tack in the dangerous semicircle and the port tack in the navigable semicircle.

(276) **Waves**.–In early March of 1980 a series of frontal atmospheric waves moved across Florida from the Gulf of Mexico. One persisted until it reached the Gulf Stream where it deepened rapidly into a powerful extratropical storm as it headed east-northeastward. Off Cape Hatteras three ships reported 40-foot seas (12 m) while several others encountered wave heights of 25 to 35 feet (8 to 11 m). The National Data Buoy Center's buoy 41001 (35.0°N., 72.0°W.) recorded a maximum wave height of 33 feet (10 m). Extra tropical and tropical cyclones are responsible for potentially similar conditions in the deep waters off this entire coast year-round. Fortunately these situations are infrequent. However, it has been calculated that in an average 5-year period, significant wave heights of 40 to 50 feet (12 to 15 m) and extremes of 70 to 90 feet (21 to 27 m) are possible. These figures decrease with latitude (40 feet and 70 feet (12 and 21 m) off southern Florida.)

(277) The table below (extracted from Marine Weather of Western Washington, Kenneth E. Lilly, Jr., Commander, NOAA, Starpath School of Navigation, 1983), shows the relationship between significant and other wave heights.

Wave Heights from Significant Wave Heights (SWH)	
Most frequent wave heights:	0.5 x SWH
Average wave heights:	0.6 x SWH
Significant wave height (average height of highest 33%)	1.0 x SWH
Height of highest 10% of the waves:	1.3 x SWH
One wave in 1,175 waves:	1.9 x SWH
One Wave in 300,000 waves:	2.5 x SWH

(278) This table can be used to project a range of wave heights that might be expected in deep water. If significant wave heights of 10 feet (3 m) are forecast then the most frequently observed waves should be in the 5 to 6 foot (2 to 3 m) range while one wave in 100 should reach 17 feet (5 m). A giant or rogue wave might reach 25 feet (8 m) in these circumstances. These rogue or "Killer" waves occur when the large number of different waves that make up a sea occasionally reinforce each other. This action creates a wave that is much steeper and higher than the surrounding waves. These rogue waves often occur in a stormy sea and are described by mariners who have experienced them, as coming out of nowhere and disappearing just as quickly. If significant wave heights are observed at 20 feet (6 m) then a rogue wave could reach 50 feet (15 m) if the water depth could support it.

(279) In general, sea conditions are roughest from about October through March or April. Seas of 8 feet (>2 m) or more can be expected along deep water coastal routes north of Florida about 15 to 30 percent of the time and 5 to 15 percent of the time off Florida.

(280) Steep waves are often more dangerous than high waves with a gentle slope. Waves appear menacing when the ratio of wave height to length reaches about 1/18. They begin to break when this ratio is about 1/10. Steepest waves develop when strong winds first begin to blow or early in a storm's life. The ship no longer rides easily but is slammed. Steep waves are particularly dangerous to small craft. When wave heights are greater than 5 feet (1.5 m), periods of less than 6 seconds can create problems for boats under 100 feet (30 m) in length. Waves of 10 feet (3 m) or more with periods of 6 to 10 seconds can affect comfort in vessels 100- to 200-feet (30 to 60 m) in length and provide a rough ride for larger ships.

(281) Waves moving into shallow water become steeper and break when the depth is about 1.3 times the wave height. Areas such as Diamond Shoals and Mantilla Shoal are dangerous in heavy weather as are most of the inlets along this coast. Wave steepness is also increased by tidal currents, particularly when they oppose the wind.

(282) Swells can create problems for larger vessels. About one-half of the waves of 10 feet (3 m) or more, in these waters, are swells from distant storms. They are uncomfortable to ships that roll or pitch in sympathy. Swells with 500- to 1,000 foot (152 to 305 m) wave lengths affect ships of these lengths. When steaming into such swells a resonance is set up until the bow digs into the waves. The resulting pitch will cause more of a power loss than a roll caused by a sea. Swells with wave lengths that range from about three-fourths to twice the ship's length can have this effect. Pitching is heaviest when the ship's speed produces synchronism between the period of encounter and the ship's natural pitching period. This often occurs at or near normal ship speeds.

(283) When running before a following sea the greatest danger arises when your speed is equal to that of the waves or when the waves overtake the ship so slowly that an almost static situation is created with the vessel lying on the wave crest. In this latter case, stability is so reduced that a small vessel could capsize. Waves on the quarter or astern can also result in very poor steering quality. As seas move along the vessel from aft to forward the rudder is less effective and the boat may be slewed across the face of a sea filling the decks with water as she broaches. She could lose her stability and capsize, particularly if the boat is trimmed by the head.

(284) The Gulf Stream not only affects the winds of coastal storms but modifies waves by their interaction with the currents. This interaction is enhanced in the North Wall, a narrow, horizontal band of extreme water temperature change marking the north edge of the Gulf Stream. The North Wall also indicates the region where strong northeasterly currents will be encountered; they reach a maximum value 10 to 20 miles (19 to 37 km) farther into the Gulf Stream. Particularly during February and March, when water temperature gradients are steepest to the north, a coastal storm may draw cold Arctic air across the slope water and along the coast to Cape Hatteras by strong northeasterly winds. An 18° to 20°F (10° to 11°C) jump in water temperature occurs creating highly unstable air and increased surface winds with more gustiness and turbulence. Higher waves are generated by the windspeed increase and these waves are likely to be more confused due to the turbulence. In addition to this wave height increase, more serious changes in the wave characteristics are produced by the currents. Northeasterly seas encounter opposing currents of from 3 to 5 knots and, as is commonly observed in inlets when incoming waves encounter an ebbing tide, the result is sharply increased wave heights and much steeper wave slopes. If the opposing current is sufficiently strong the waves will even break. This steepening action causes problems for small craft navigating inlets with waves only a few feet high; with 20- to 30-foot (6 to 9 m) waves the result may be dangerous to any ship. To avoid this problem it is suggested that in late winter and spring cross the Gulf Stream as far east as possible, where it is likely that the cold air would have modified somewhat and thus reduce the instability effect.

(285) **Visibilities**.–Visibilities are generally good throughout the year, particularly offshore south of Charleston. Fog is the principal restriction to visibility. Onshore and along the coast this is often a radiation type fog, which forms shortly after sunset on cool, calm, clear nights. These fogs generally do not extend any great distance seaward, but may seriously restrict harbor activities. They often burn off during the morning hours. Sea fogs occasionally drift onshore on hot summer days, persisting for many hours in a shallow layer along the coast. Foggy conditions vary widely at coastal locations depending upon exposure. In general, the number of days that visibilities fall to ¼ mile or less, ranges from 20 to 40 days annually, north of Cape Canaveral. These conditions are most likely from October through April.

(286) West of the Gulf Stream sea fog may occur over cooler waters when warm air is brought in from the south. These conditions are most likely over coastal waters from Norfolk to Charleston during January, February and March. During these months visibilities drop below ½ mile on 1 to 5 percent of all ship observations. Conditions are worst from Cape Henry to Cape Hatteras. In addition to fog, precipitation occasionally reduces

visibility over both land and water while haze and smoke sometimes restrict it over land.

(287) **Winds**.–Along most of the southern Atlantic Coast, winds are determined by migratory high and low pressure systems; in summer the semipermanent Azores High is an important factor. Most of the Florida coast lies in the easterly trade wind system at least part of the year. Other influences include the Appalachian Mountains and local coastal topography. Strongest winds are generated by the tropical and Extratropical low pressure systems and cold fronts. Locally, thunderstorms can cause short periods of strong, gusty winds.

(288) In the offshore waters, gales are most likely from October through April. North of about 30°N., along the coastal routes, they can be expected 5 to 10 percent of the time. Winds are variable although those with northerly and westerly components are most frequent. To the south, gale frequencies drop off to about 5 percent or less, decreasing with latitude; south of 30°N., winds in the 22- to 33-knot range are encountered about 10 to 15 percent of the time. Winds are variable but southwesterlies through northeasterlies are common. Easterlies become increasingly frequent south of Jacksonville. Summer winds in offshore waters are steadier but weaker, mainly due to the dominance of the Azores High. North of 30°N., southerlies and southwesterlies prevail. Gales are infrequent and even windspeeds in the 22- to 33-knot range occur less than 10 percent of the time. South of Jacksonville, easterlies and southeasterlies predominate with average speeds of about 8 to 10 knots. It isn't usually until late September, when the Azores High recedes, accompanied by an increase in migratory pressure systems, that winds become stronger and more variable.

(289) Coastal winds are more complex due to topographical influences and the land-sea breeze effect. Along the coast a daily shift in wind direction is often observed. During the warmest part of the day winds blow from the ocean toward shore (known as a sea breeze), and during the coolest, from the land toward the sea (land breeze). Offshore winds, unless they are exceptionally strong, are generally considered most favorable for coastal navigation. Onshore winds have a more pronounced effect upon the surface, particularly when they have been blowing from the same direction for a long period of time. A strong sea breeze can cause heavy or choppy seas and swells, and frequently makes navigation difficult for small vessels.

(290) Windspeeds along the southeastern coast of the U.S. are generally moderately light, averaging 8 to 12 knots over the year. Monthly averages vary in summer from 6 to 10 knots and 8 to 15 knots in winter. Wide departures from these averages should be expected in all seasons. In the immediate coastal area, the windward side of the promontories may be lashed by gales and heavy seas, while the lee side is relatively protected. Averages do not show these variations. The area from Cape Hatteras to Cape Henry, exposed as it is to the ocean, is subject to severe northeasterly ocean storms as well as migratory continental pressure systems. Cape Hatteras is particularly exposed to the winds, with open sea from north through east to southwest. South of Cape Hatteras gales are much less frequent, occurring generally on less than 15 days annually. The frequency of calms is dependent upon season, exposure, and time of day. They are least frequent during the afternoon when they occur less than 5% of the time along the entire southeastern Atlantic coast; in many locations calms are recorded less than 2% of the time. During the morning hours, particularly in summer and fall, they occur 5 to more than 15% of the time. Calms are least frequent at Cape Hatteras. Daytona Beach records the largest range in July, August and September, when morning calms occur about 25% of the time, compared to less than 2% of the time during the afternoon.

(291) Extreme windspeeds are a hazard in any month. Though winds greater than 34 knots are infrequent, they have been recorded all along the southeastern U.S. coast almost any time of the year. Gales usually accompany sharply defined frontal systems, tropical storms, hurricanes and severe local thunderstorms.

(292) **Temperature**.–The temperature regime of the southern Atlantic coast varies from temperate in the north to subtropical in the south. The gradation from north to south is regular, increasing with decreasing latitude. Another interesting variation is the general modification process of the ocean and coastal temperatures by each other. Along the coast, sheltered land stations have warmer summers and cooler winters than stations with greater exposure to the water.

(293) Temperatures along the southeastern seaboard region are conducive to a long season of small-craft operation. The southern Atlantic coast annual mean air temperatures range from 59.5°F (15.3°C) at Norfolk, VA, to 77.7°F (25.4°C) at Key West, FL. January is the coldest month at most stations; July the warmest. Mean monthly air temperatures range from 39.9°F (4.4°C) at Norfolk in January to 84.5°F (29.2°C) at Key West in July.

(294) Over the water the coldest month is February and the warmest is August. Exposed coastal stations experience mean air temperatures more like those over the water. The daily variation in temperature ranges from 10° to 17°F (5.6° to 9.5°C) at coastal stations throughout the year and is less over the water. The largest daily variation occurs during the winter and early spring and the smallest during late summer and fall.

(295) Very little data on extreme temperatures for the ocean areas are available. At coastal stations temperatures above 100°F (37.8°C), while not common, have been recorded. The highest during the period of record considered was 105°F (40.6°C) at Jacksonville, FL, in July. The lowest recorded temperature was 5°F (-15°C) at Norfolk, VA, in January.

(296) **Precipitation**.–Along the southeastern Atlantic coast precipitation is moderately heavy, averaging about 45 to 60 inches (1,143 to 1,524 mm) a year. Monthly departures may be large in any individual year, but over a long period of record, a fairly uniform pattern prevails. Since the area is within both temperate and subtropical regions, the precipitation pattern shows differences in both type and amount from north to south. Irregularities are often due to differences of exposure at the observing stations. Year-to-year variation is caused by overall departures from the average, general circulation.

(297) In the northern part of the area, maximum rainfall occurs normally during July and August, with a minimum in November. In the southern section, however, maximums occur in September or October, and the least in February. Average monthly totals at most stations range from 2 to 6 inches (51 to 152 mm) throughout the year. During the months of greatest hurricane frequency, excessive rains of 9 to 15 inches (229 to 381 mm) in a 24-hour period have recorded. These may occur at any point along the coast, but are most common in the southern part of the area.

(298) The monthly mean number of days with 0.01 inch (0.254 mm) or more of precipitation in the northern part of the area ranges from about 8 days per month in the fall to 10 to 12 days per month in the summer and winter. In the central part of the area the most rainy days are in summer, 11 to 16 days per month, and the least in spring and fall, 6 to 9 days per month. The most rainy

days along the Florida coast, 14 to 18 days per month, generally occur in late summer and early fall, and the minimum number, 5 to 8 days per month, from February through April.

(299) Much of the precipitation, like cloudiness, is associated with cyclonic activity throughout the year. During the winter, precipitation is usually steady, but may come with an occasional thunderstorms along a front. Frontal systems originating or developing in the Gulf region result from the interaction of a moist tropical air mass with colder continental masses. They move eastward or northeastward and bring extensive precipitation to the seaboard region. During the summer, when the area is dominated by the Azores High and cumulus clouds predominate, precipitation is localized and is showery in nature. Heaviest precipitation occurs over land and near coastal waters in the afternoon; over open water it is most likely during the night.

(300) Thunderstorms along the coast occur on an average of from 40 days per year in the north to 80 days per year in the south. Maximum occurrence is from June through August, and an average of 7 to 18 thunderstorms per month occur during this season. In summer, cumulus clouds frequently develop into thunderstorms over the land and drift seaward late in the afternoon.

(301) Snow falls from December through March in the northern part of the area on 1 or 2 days per month. So far as coastal operations are concerned, snow conditions are not significant since most of the area is entirely free from snow the year-round.

(302) **Cloudiness**.–Mean cloudiness over the area is moderate to moderately high throughout the year, averaging from 35 to 65 percent sky cover. In general, however, the cloudiest month is January in the northern sections and over most of the water areas, and may be any month from June through September in the south. At most locations in the north the least cloudiness occurs in October, and in the extreme southern part in February or March. Since the air is usually moist, only a small decrease in temperature may cause condensation and cloud formation. At the edge of the warm, northward moving Gulf Stream and the cool southward moving countercurrent which skirts the shore from Cape Hatteras, N.C. to Jacksonville, Fla., sharp contrasts in temperatures result in the formation of heavy stratus clouds which may appear very much as a cold front. These clouds may persist for days at a time if the wind is light and may be carried inland by northeasterly winds. Such cloudiness is common during the spring when the gradient between shore water and Gulf Stream temperatures are steepest. The fact that maximum cloudiness for the year occurs during the winter at the northern coastal stations may be explained by the maximum frequency of storms passing northward or northeastward from the central or south-central section during the season. These rarely affect the extreme southern part of the area.

(303) Much of the cloudiness over the entire area is of the cumulus type, resulting from either the unstable conditions that accompany cyclonic activity in all seasons, or the general air mass instability during the summer. Such clouds frequently form over land during the day and drift seaward at night.

(304) **Immersion Hypothermia**.–Immersion hypothermia is the loss of heat when a body is immersed in water. With few exceptions, humans die if their normal rectal temperature of approximately 99.7°F drops below 78.6°F. Cardiac arrest is the most common direct cause of death. Except in tropical waters warmer than 68° to 77°F, the main threat to life during prolonged immersion is cold or cold and drowning combined.

(305) Cold lowers body temperature, which in turn slows the heartbeat, lowers the rate of metabolism, and increases the amount of carbon dioxide in the blood. Resulting impaired mental capacity is a major factor in death by hypothermia. Numerous reports from shipwrecks and accidents in cold water indicate that people can become confused and even delirious, further decreasing their chances of survival. The length of time that a human survives in water depends on the water temperature and, to a lesser extent, on a person's behavior. The table below shows the approximate human survival time in the sea. Body type can cause deviations, since thin people become hypothermic more rapidly than fat people. Extremely fat people may survive almost indefinitely in water near 32°F if they are warmly clothed.

Survival Time versus Water Temperature

Water Temperature	Exhaustion or Unconsciousness	Expected Time of Survival
32°F	15 min.	15-45 min.
32°-41°F	15-30 min.	30-90 min.
41°-50°F	30-60 min.	1-3 hrs.
50°-59°F	1-2 hrs.	1-6 hrs.
59°-68°F	2-7 hrs.	2-40 hrs.
68°-77°F	3-12 hrs.	3 hrs. - indef.
77°F and above	indefinite	indefinite

(306) The cooling rate can be slowed by the person's behavior and insulated gear. In a study which closely monitored more than 500 immersions in the waters around Victoria B.C., temperatures ranged from 39° to 60°F. Using this information it was reasoned that if the critical heat loss areas could be protected, survival time would increase. The Heat Escape Lessening Posture (HELP) was developed for those in the water alone and the Huddle for small groups. Both require a life preserver. HELP involves holding the upper arms firmly against the sides of the chest, keeping the thighs together, and raising the knees to protect the groin area. In the Huddle, people face each other and keep their bodies as close as possible. These positions improve survival time in 48°F water to 4 hours, approximately two times that of a swimmer and one and one-half times that of a person in the passive position. The U.S. Coast Guard has an easy to remember rule of thumb for survival time: 50 percent of people submersed in 50°F water, will die within 50 minutes.

(307) Near-drowning victims in cold water (less than 70°F) show much longer periods of revivability than usual. Keys to a successful revival are immediate cardiopulmonary resuscitation (CPR) and administration of pure oxygen. Don't bother with total rewarming at first. The whole revival process may take hours and require medical help. Don't give up!

(308) **Wind Chill and Frostbite**.–When the body is warmer than its surroundings it begins to lose heat. The rate of loss depends on barriers such as clothing and insulation, the speed of air movement and the air temperature. Heat loss increases dramatically in moving air that is colder than skin temperature (91.4°F). Even a light wind increases heat loss while a strong wind can actually lower the body temperature if the rate of loss is greater than the body's heat replacement rate.

(309) The equivalent wind chill temperature relates a particular wind and temperature combination to whatever temperature would produce the same heat loss at about 3 knots, the normal

speed of a person walking. At extremely cold temperatures, wind and temperature effect may account for only two-thirds of the heat loss from the body. For example, in 40°F temperatures about one-third of the heat loss from the body occurs through the lungs in the process of breathing. On the other hand, heat loss is not as great in bright sunlight.

(310) When the skin temperature drops below 50°F, there is a marked constriction of the blood vessels leading to vascular stagnation, oxygen want, and some cellular damage. The first indication that something is wrong is a painful tingling. Swelling of varying extent follows, provided freezing has not occurred. Excruciating pain may be felt if the skin temperature is lowered rapidly, but freezing of localized portions of the skin may be painless when the rate of change is slow. Cold allergy is a term applied to the welts which may occur. Chilblains usually affect the fingers and toes and appear as reddened, warm, itching, swollen patches. Trench foot and immersion foot present essentially the same picture. Both result from exposure to cold and lack of circulation. Wetness can add to the problem as water and wind soften the tissues and accelerate heat loss. The feet swell, discolor, and frequently blister. Secondary infection is common and gangrene may result.

(311) Injuries from the cold may, to a large extent, be prevented by maintaining natural warmth through the use of proper footgear and adequate, dry clothing; by avoiding cramped positions and constricting clothing; and by active exercise of the hands, legs and feet.

(312) Frostbite usually begins when the skin temperature falls within the range 14 to 4°F. Ice crystals form in the tissues and small blood vessels. Once started, freezing proceeds rapidly and may penetrate deeply. The rate of heat loss determines the rate of freezing, which is accelerated by wind, wetness, extreme cold, and poor blood circulation. Parts of the body most susceptible to freezing are those with surfaces large in relation to their volume, such as toes, fingers, ears, nose, chin and cheeks.

(313) **Dew Point**.–The temperature at which condensation to water droplets occurs is called the dew point. If this dew point is above freezing, condensation will be in the form of water. When the dew point reaches freezing, ice crystals will be deposited on cold surfaces. Knowledge of the dew point along the cargo temperature and moisture content is vital for hold ventilation decisions. It is also a parameter used in forecasting fog formation.

(314) **Cargo Care**.–When free air has a dew point temperature higher than the temperature of the surface with which it comes in contact, the air is often cooled sufficiently below its dew point to release moisture. When this happens on board ship, condensation will take place on relatively cold cargo or on the ship's structure within the hold where it later drips onto the cargo. Thus, if cargo is stowed in a cool climate and the vessel sails into warmer waters, ventilation of the hold with outside air will likely lead to sweat damage in any cargo sensitive to moisture. Under such conditions external ventilation should, as a rule, be closed off entirely, unless the cargo generates internal heat, that hazard being greater than sweat damage. In the opposite case, when a vessel is loaded during a warm period, and moves into cooler weather, vulnerable cargo should be ventilated.

(315) A safe rule for ventilation directed toward moisture control may be stated as follows: Whenever accurate measurements show the outside air has a dew point below the dew point of the air surrounding the cargo to be protected, such outside air is capable of removing moisture from the hold and the ventilation process can be safely started. Whenever the reverse is true, and the outside dew point is higher than the dew point temperature around the cargo, then ventilation will increase the moisture content of the hold and may readily result in sweating within the ship. The above does not take into account possible fumes or gases in the compartment. In such case discretion must be used.

(316) **Principal ports.–**The ports within the area of this Coast Pilot which have deep-draft commercial traffic are Morehead City, N.C.; Wilmington, N.C.; Georgetown, S.C.; Charleston, S.C.; Port Royal, S.C.; Savannah, Ga.; Brunswick, Ga.; Fernandina Beach, Fla.; Jacksonville, Fla.; Port Canaveral, Fla.; Fort Pierce, Fla.; Port of Palm Beach (near West Palm Beach), Fla.; Port Everglades (Fort Lauderdale), Fla; Miami, Fla.; and Key West, Fla. The larger ports of the group are Wilmington, Charleston, Savannah, Jacksonville, Port Everglades, and Miami. Jacksonville is the largest port on the east coast south of Hampton Roads and is a major ship repair center.

(317) **Pilotage, general.–**Pilotage is compulsory for all foreign vessels and U.S. vessels under register in the foreign trade at the ports where state pilots are available. Pilotage is optional for coastwise vessels who have on board a pilot properly licensed by the Federal Government. Only at Wilmington, Charleston, Savannah, and Jacksonville is there a pilot station which is manned 24 hours daily; at the other ports, arrangements for pilots must be made well in advance. Detailed information on pilotage procedures is given in the text for the ports concerned.

(318) Local boatmen or fishermen competent to act as pilots for parts of the Intracoastal Waterway and interior waters can usually be found at the larger cities and towns along the route or near the entrances to the various tributaries.

(319) **Towage.–**Tugs are available at most of the major ports; they can usually be obtained for the smaller ports on advance notice if none are available locally. Arrangements for tugs should be made in advance through the ships' agents or the pilots. See the text for the ports concerned as to the availability of tugs.

(320) **Vessel Arrival Inspections.–**Quarantine, customs, immigration, and agricultural quarantine officials are stationed in most major U.S. ports. (See Appendix for addresses.) Vessels subject to such inspections generally make arrangements in advance through ships' agents. Unless otherwise directed, officials usually board vessels at their berths.

(321) **Harbormasters** are appointed for some of the principal ports. They have charge of enforcing harbor regulations, and in some instances are in charge of the anchorage and berthing of vessels.

(322) **Supplies.–**Fuel oil, diesel oil, and all other supplies and services for large vessels are available at Morehead City, Wilmington, Charleston, Savannah, Jacksonville, Port Everglades, and Miami. Fuel oil and diesel oil are available locally, or can be barged or trucked in from another port, at Georgetown, Port Royal, Brunswick, Fernandina Beach, Fort Pierce, Port of Palm Beach, and Key West; other supplies and services for ships are limited at these ports.

(323) **Repairs.–**Large oceangoing vessels can be drydocked and have major repair work done at Cainhoy (Near Charleston), Savannah and Jacksonville with the largest drydock capacity of 33,000 tons (Jacksonville). Smaller vessels from 300 to 1,200 tons may also be drydocked at New Bern, Wilmington, Johns Island, Mayport, Miami, and at Safe Harbor. (See text for details.)

(324) **Small-craft facilities.–**Supplies, and repair facilities for small craft are at all the ports and at numerous places along the

Intracoastal Waterway and on the tributaries branching from it. For isolated places and small cities, the Coast Pilot describes the more important of these facilities; for large port areas, where individual facilities are too numerous to mention, the information given is more general. Additional information may be obtained from the series of small-craft charts published for the many places, and from various local small-craft guides.

(325) **A vessel of less than 65.6 feet (20 meters) in length or a sailing vessel shall not impede the passage of a vessel that can safely navigate only within a narrow channel or fairway. (Navigation Rules, International-Inland Rule 9(b).)**

(326) **Standard time.**–The area covered by this Coast Pilot uses eastern standard time (e.s.t.), which is 5 hours slow of Greenwich mean time (G.m.t.). Example: When it is 1000 at Greenwich it is 0500 along this coast.

(327) **Daylight saving time.**–Throughout the area of this Coast Pilot, clocks are advanced 1 hour on the first Sunday in April and are set back to standard time on the last Sunday in October.

(328) **Legal public holidays**.–New Year's Day, January 1; Martin Luther King, Jr.'s Birthday, third Monday in January; Washington's Birthday, third Monday in February; Memorial Day, last Monday in May; Independence Day, July 4; Labor Day, first Monday in September; Columbus Day, second Monday in October; Veterans Day, November 11; Thanksgiving Day, fourth Thursday in November; and Christmas Day, December 25. The national holidays are observed by employees of the Federal Government and the District of Columbia, and may not be observed by all the states in every case.

(329) In the areas covered by this Coast Pilot, other holidays are observed: Lee-Jackson Day, third Monday in January, in Virginia; Robert E. Lee's Birthday, January 19, in all states except Virginia; Arbor Day, third Friday in January, Florida; Good Friday, Florida; Easter Monday, North Carolina; April 2, Pascua Florida Day, Florida; April 12, Halifax Day, North Carolina; April 14, Pan American Day, Florida; April 26, Confederate Memorial Day, Georgia and Florida; May 10, Confederate Memorial Day, North Carolina and South Carolina; May 20, Mecklenburg Day, North Carolina; June 3, Jefferson Davis' Birthday, South Carolina, Georgia, and Florida; General Election Day, first Tuesday after the first Monday in November, all states.